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1919

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PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE

MEDICAL AND SURGICAL SCIENCES

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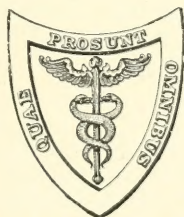
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VOLUME IV. DECEMBER, 1919

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS AND
PERITONEUM—DISEASES OF THE KIDNEYS—GENITO-URINARY DISEASES—
SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS,
FRACTURES AND DISLOCATIONS AND TUMORS—PRACTICAL
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PROGRESSIVE MEDICINE.

DECEMBER, 1919.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS AND PERITONEUM.

By EDWARD H. GOODMAN, M.D.

It is the pleasant duty of the present reviewer to take up again this section of PROGRESSIVE MEDICINE, after having abandoned the work in favor of a call to Government Service. During his absence, he has been fortunate, indeed, in having been able to obtain the coöperation of Dr. Martin E. Rehfuß, upon whose shoulders has rested the preparation of this review for the past two years. Already burdened with the important task of caring for the civilian population during the recent emergency, already filling "the unforgiving minute with sixty seconds worth of distance run," Dr. Rehfuß, cheerfully and gladly and with the enthusiasm by which he has long been characterized, accepted the responsibility requested of him, and the numbers of PROGRESSIVE MEDICINE for 1917 and 1918 will bear witness to how well his work has been accomplished. It is a great pleasure to acknowledge the indebtedness to Dr. Rehfuß and to testify that in these two years I have particularly enjoyed reading the section on "Diseases of the Digestive Tract, etc.," because they come from his skilful pen.

The war has been productive of much valuable medical information, but strangely enough the art and perhaps science of gastro-enterology has been scarcely moved to advance a foot by our military experience. We have learned much of the infectious diseases, of empyema, of sanitation, of hygiene, of the results of "moving accidents by flood and field," of psychology, collective and individual, but of diseases of the digestive tract, with the exception of occasional papers, we have learned but little as medical officers that we have not already known as medical men in civil life. Great preparations were made for the study of gastro-enterology, by the Surgeon-General's Office, and Dr. Seale Harris outlined a comprehensive plan. Specialists from many centers were sent to the various cantonments and camps, to be placed on the medical service in charge of gastric and allied cases. Struggle as they might they found their work in the wards a matter of visit and search with but little to reward them for their efforts.

At Camp Sevier, where the writer was in charge of a large medical service for several months, there was little to warrant the presence of a gastro-enterologist, although this service was created, and Captain McCaffrey was most diligent in the study of the cases. Apart from a large proportion of hookworm and an occasional appendicular condition, and a rare duodenal ulcer, the gastric cases resolved themselves into constipation, diarrhea and functional disorders, the latter particularly prevalent among new arrivals at camp, unaccustomed to army life and its many novelties, some pleasant and some, to them, otherwise. Certainly duodenal and gastric ulcer, by no means uncommon in private practice, seemed to play no part on our sick report. Can it be that the men were so well studied by the draft boards and recruiting officers that the suspects were not accepted? Can it be that the work of our dental officers whose work has not yet received the praise which is its due, has helped keep down the incidence of disabling gastric disease?

On looking over the world's literature the reviewer has been impressed, for the first time since he first undertook the preparation of this section, with the small amount of important work which the past year has produced. The press of practice has no doubt prevented our best known writers in the field of gastro-enterology from producing any thing at all commensurate with their work of previous years. And not only in American literature do we find this aridity, but the English, the French, and as much as we could obtain of the German publications, contain nothing noteworthy. We might single out possibly five conspicuous papers whose quality compares with the work of previous years, but even if the redemption of a city depended on the finding of ten, peradventure the city would be lost!

This has made the preparation of the present review a matter of great difficulty as many articles were read, but few chosen for review. Certain sections have formerly proved a mine of great wealth, and we formerly derived great profit in the writing of diseases of the pancreas, for instance, in the composition of the section of gastric ulcer, in the account of hepatic diseases, and the reader will note how little we have to say in the paragraphs under these headings, for the simple reason that but little of moment has been published.

Perhaps, with the coming of peace and the return of the army of medical men to the unrestricted opportunities for clinical research, impossible to those in Service, there will eventually appear throughout the world's literature, a resumption of the interest in gastro-intestinal work which will enable future numbers of *PROGRESSIVE MEDICINE* to hold once more the attention and interest of those who like to follow year by year the subject of gastro-enterology.

DISEASES OF THE ESOPHAGUS.

Stenosis of the Esophagus. Torres¹ comments on the remarkable prevalence of esophagus disturbances in his district (Granada). In a

¹ Abstract, Journal of the American Medical Association, 1919, lxxii, 231.

recent eight months there were 31 cases of stenosis at the clinic or in his private practice, and he here gives the details of this series. The roentgen rays show a large diverticulum in some. Most of the patients were men from forty to sixty years, but one was a young man of eighteen years. In all, the disturbances had come on gradually after gastric symptoms had existed for a long time, and in several cases other members of the family had likewise had stomach and esophagus trouble. In only 1 of the total 31 cases was the stenosis the result of drinking a caustic; this was a girl of five years who had drunk hydrochloric acid five months before. No mention is made of the treatment in any case.

Hysteric Spasm of the Esophagus. The five-year old girl presented a grave clinical picture exactly like that with stenosis from corrosion by a caustic. Monrad² commenced dilatation with a fine catheter, and found that the esophagus was completely permeable. The child had actually drunk some caustic, but the first symptoms of stenosis did not appear until three months later after she had heard of a relative who had developed stenosis from such a cause. In a boy of five years the conditions seemed to indicate a congenital diverticulum in the esophagus, but in this case also the esophagus proved to be normal on roentgenoscopy and under chloroform—although every attempt to introduce a catheter met with impassable resistance at the lower third. In this case the spasm in the esophagus had been noticed during the first year of life, the spasm occurred at different levels of the esophagus at different times, and the esophagus returned to apparently normal size and shape afterward, with no tendency to dilatation. In a third case, a girl of six years had had typical hysterical anorexia for several years, and Monrad was not surprised when the child developed the clinical picture of a diverticulum of the esophagus. A surgeon consulted counselled gastrostomy to strengthen the child for an operation on the esophagus, but Monrad found that the spasm subsided abruptly under introduction of a No. 31 catheter, after the smaller series had been constantly arrested at a point 25 cm. from the teeth. The child was apparently completely cured of all disturbances and ate with good appetite for weeks, but was brought back to the hospital a month after her dismissal presenting the same clinical picture of stenosis as before. Again it yielded to catheter treatment. In the second of the three cases, the threat of catheter treatment sufficed to arrest the spasm on several occasions.

DISEASES OF THE STOMACH.

In the *Lancet* of 1919, there is a series of four Croonian Lectures by Brown, on "The Role of the Sympathetic Nervous System in Disease," which lectures contain as able an exposition of the subject as one might wish to read. They appeared May 17, 24, 31 and June 7, and the second lecture is devoted to "The Sympathetic

² Abstract, Journal of the American Medical Association, 1918, lxxi, 1950.

Nervous System and Diseases of Digestion." It may be without the province of this review to deal with any material not directly referring to Diseases of the Alimentary Tract but I can not forbear to quote freely, sometimes verbatim for the sake of clarity, from the first lecture dealing with the "Plan of the Autonomic System," in order that the second lecture dealing essentially with the subject of our review, may be the better understood. I do not expect that this abstract can offer all the information the reader may require, but, if it attains its object of stimulating him to study the original articles, much will have been accomplished. In no better way can this present review be commenced than by a lengthy reference to these admirable lectures by Brown.

He first pays tribute to the memory of his great teacher Gaskell, who was the first to make clear the direction of the impulses in the sympathetic chain. "To read an account of the sympathetic nervous system before Gaskell is like reading a description of the circulation of the blood before Harvey." Gaskell first showed that the nerve fibers of the sympathetic group were of smaller calibre than the nerves to the skeletal muscles, and hence he was able to show that there were fibers with visceral functions in the cranial and sacral nerves, subserving the functions of organic life and not under the control of the will. The term "autonomic nervous system" devised by Langley, is one in general use, and Brown classifies the whole of the visceral or involuntary nervous system as follows:

Autonomic Nervous System. 1. Sympathetic (thoracico-lumbar outflow).

2. Parasympathetic.

(a) Cranial outflow.

(b) Sacral outflow.

These three groups of fibers are separated by the cervical and lumbar enlargements of the cord, which are devoted to the innervation of the somatic muscles of the limbs.

The essential parts concerned in a reflex action are the receptor and excitor elements, the former consisting of afferent nerve, nerve cell and afferent root ending in the cord against another neuron, and the latter consisting of efferent nerve, nerve cell in the anterior horn of the cord with its axon to the muscle. Not in all cases does the receptor element directly connect with the excitor, but there is an intermediate neuron for which Gaskell suggested the name "connector element." In the autonomic system the outflow of small medullated fibers represents the connector element, while the excitor element is represented by a cell in the sympathetic ganglion, with its axon. Every one of these small medullated strands ends in one or more sympathetic ganglia, from where a new non-medullated fiber passes to its ultimate destination. "Hence there is a connector pre-ganglionic medullated fiber and an excitor postganglionic non-medullated fiber." The somatic nerves are for localized accurate reflexes and the visceral nerves for widespread diffuse effects.

Path of Sympathetic Outflow. The fine, medullated, preganglionic connector fiber springs from a cell in the lateral horn, whence it passes

out in the anterior root, leaving by a white ramus communicans, to enter the sympathetic chain. It ends by forming synapses around cells in the lateral or in the more outlying sympathetic ganglia, as the superior cervical and mesenteric ganglia. A number of cells may thus be stimulated by a single fiber. From these cells start the non-medullated postganglionic excitor fibers, passing to their destination, mainly along bloodvessels to the deeper parts, and along spinal nerves to the more superficial parts, being distributed to the latter by the gray rami communicantes. This arrangement allows of side radiation of sympathetic impulses, as is seen by stimulation of a single gray ramus, when erection of hairs occurs over a number of areas, usually 5 or 6. The sympathetic ganglia, therefore, act as distributing stations, and although every sympathetic impulse has one cell station outside the cord, no impulse passes through more than one such station; the excitor fiber runs straight to its destination.

Parasympathetic. There are certain features of resemblance between the sympathetic and parasympathetic systems. They both control functions of organic life and act apart from the will. They are both composed of small medullated connector fibers and conform to the rule that no efferent autonomic impulse runs from the central nervous system to muscle or gland without having a nerve cell on its course. The postganglionic fibers do not run to other nerve cells of the system, but branching, are distributed direct to the peripheral tissues. But they have their cell station close to their destination, so that their effects are more localized and less widely distributed.

The cranial portion of the parasympathetic sends fibers in the third nerve by way of the ciliary ganglion, to constrict the pupil; in the seventh nerve through the chorda tympani *via* Langley's and the sublingual ganglion, to the submaxillary and sublingual glands, and in the ninth nerve *via* the otic ganglion to the parotid gland. But the main cranial parasympathetic nerve is the vagus, which is distributed to the alimentary canal and its outgrowths,—lungs, liver, gall-bladder and pancreas. The cell stations for the cardiac fibers are in the heart and those for the alimentary fibers are in the plexus of Auerbach, and while the cranial sympathetic nerve (vagus) is motor and secretory to the alimentary tract and its outgrowths, it is inhibitory to the heart.

The sacral portion of the parasympathetic consists of the pelvic visceral nerve. It may be regarded as a mechanism for emptying.

This, in a general and confessedly insufficient way, gives a synopsis of the first part of Brown's first lecture. Now the second has to do with the subject of digestion, and again the reviewer admits his inability to condense the matter into a small space; therefore, since that is avowedly impossible, he would acknowledge that he has used in many places Langdon Brown's own words even quoting many paragraphs verbatim, although not all such are thus distinguished by the customary quotations marks.

"The object of digestion is to reduce the food molecules into a form capable of passing through a membrane. For this purpose two proc-

esses are brought into play—chemical and mechanical. Juices containing active chemical substances are poured into the food, while these are aided by the mechanical processes of mastication, deglutition and peristalsis, by which every article of food is brought into contact first with the active juices and then with the absorbing membrane.” The dominant nervous agent is the parasympathetic system, both on the secretory and motor sides. The vagus controls the digestive processes right down to the point at which the sacral division of the parasympathetic takes charge. Brown gives briefly Gaskell’s theory in his (Brown’s) words:

Gaskell’s Views on the Origin of the Vertebrates. “At the time when the vertebrate first appeared, arthropods like those of the present day had not been evolved. We may therefore regard the ancestor of the vertebrate as being much nearer the annelid stage. The central nervous system of the invertebrates formed the central nervous system of the vertebrates by growing round and enclosing the alimentary canal of the former, which persists as the ventricles of the brain and the central canal of the cord; so that the alimentary canal of the vertebrate is a new formation derived from structures already existing in the invertebrate ancestor.

“He regarded the new alimentary canal as formed by the fusion of a number of branchial appendages, the striated muscles of which are supplied by the facial, glossopharyngeal and vagus nerves. At first the chamber so formed extended right up to a similar chamber, also formed, possibly, by appendages at the anal end of the body, and opened into that chamber. So that originally, as at present in the arthropods, the double segmentation due to appendages and trunk muscles existed throughout the whole length of the animal. As new body segments were formed, by which greater mobility was gained, there would not be a corresponding formation of new appendages of the invertebrate type, but the new-formed gut would simply lengthen and its muscles would be supplied by those nerves already formed. Hence the distribution of the vagus right up to the point at which the pelvic visceral nerve takes control.

“On the other hand, the limbs of the vertebrate are a new outgrowth from the longitudinal muscles of the body, which outgrowth must carry its investments of skin with it. Hence the absence of visceral fibers from the new part of the cord corresponding to this, and hence, also, the drawing out into the sweat-glands, hair follicles and bloodvessels of the limb, of the sympathetic fibers which always supply these structures. Hence, again, the reason for the segmental skin areas being arranged pre-axially and post-axially, and not circularly as they are around the trunk.

“This phylogenetic theory is necessary to the comprehension of the absence of a segmental arrangement of the muscles of the alimentary canal, and of the meeting within it of such widely separated anatomical units as nerves of bulbar and sacral origin.”

Function of Parasympathetic and Sympathetic. The two systems are antagonistic throughout the alimentary tract. The parasympa-

thetic produces those sensations of hunger which lead to food being taken. It starts and maintains, in part, the secretion of digestive juices; it produces esophageal peristalsis; plays an important role in gastric peristalsis; it maintains intestinal tone. It also controls the final evacuation of feces; is anabolic.

Secretion of Digestive Juices. The salivary glands are stimulated through the chorda tympani and auriculotemporal nerves. The secretion of gastric juice begun by the vagus is still further carried on by gastric secretion in the pyloric glands; the secretion of pancreatic juice is due to the secretion in the duodenal mucosa produced by the action of hydrochloric acid on the prosecretin, but even here nervous mechanisms play a role. It will be remembered that pancreatic secretin can be obtained by vagus stimulation (Cathcart), and Brown quotes a case of Clayton-Greene in which pancreatic juice was poured through a pancreatic fistula the moment food was seen, evidently an instance of nerve influence. However, although the parasympathetic initiates digestive secretion, it is certain that nervous factors become less important as food passes along the alimentary canal and chemical factors become more important. Thus it follows that the antagonistic action of the sympathetic on secretion is more apparent in the inhibition of salivary secretion than of gastric or pancreatic. Brown illustrates this by the dry mouth of fear, and says this phenomenon is the basis for the old Indian "rice ordeal" in which persons suspected of crime were given rice to chew. The man who spat it out dry was adjudged guilty for the fear of detection had stopped the flow of saliva. Inhibition of gastric secretion through the influence of emotions has been repeatedly shown in fistula animals.

From the moment food passes between the pillars of the fauces it is directed by the autonomic nervous system. The parasympathetic assumes control and a slow peristaltic wave initiated by the vagus, passes along the esophagus. When the bolus enters the stomach, it passes rapidly, and with no peristaltic waves, to the pyloric portion and here waves about three in a minute sweep it on; the absence of waves at the cardiac end enables digestion of starch to continue while gastric digestion proceeds at the pyloric end. Hence a physiologic reason for carbohydrates at the end of the meal. As the stomach empties it is pulled up, so that the pylorus becomes the lowest part. Long after the fundus is quiescent, the pyloric portion contains food, and digestion continues together with the active milling of the food particles. This great activity of the pyloric portion explains, in a measure, the greater frequency of pyloric ulcers.

Two kinds of movements are observed when the food enters the small intestine:

1. Pendulum or segmentation movements travelling at the rate of 2 to 5 cm. a second and depending on muscle tone. These movements do not propel the contents but act merely as a mixing apparatus by forming a number of alternately constricted and dilated areas, each of which is divided exactly into two by the next movement.

2. Peristaltic movements, constriction following immediately on dilatation so that the contents are always being driven from a contracted into a dilated area. Bayliss and Starling believe these waves depend on the plexus of Auerbach, but if this is true, it is the only example of a true local nervous reflex, and Brown quotes Gaskell as advising caution in accepting this view. No doubt the vagus increases these waves and the splanchnic inhibits them. (See Alvarez on Metabolic Gradient Underlying Intestinal Peristalsis.)

As regards the large intestine, it may be divided into three non-anatomical portions: (1) The proximal part, characterized by the presence of autoperistaltic waves; (2) an intermediate part, distinguished by the type of wave seen in the small intestine; (3) a distal portion, the rectum, where the central nervous system again assumes control.

Brown summarizes Keith's conception of alimentary movements, a conception which will be found fully described in *PROGRESSIVE MEDICINE*, December, 1916, p. 101. It may not be amiss to refer to this theory of Keith in the words of Brown: "He (Keith) has likened the alimentary tract to a railroad, divided into block sections, each provided with its signalman and telephonic apparatus. The signalman of one section refuses to accept any further traffic until his section is clear; all the other sections are closely correlated, if one is blocked, the others too become automatically blocked. He divides the sections as follows:

"1. The pharyngeal section, ending in a sphincter at the upper end of the esophagus.

"2. The cardiac sphincter marks the end of the esophageal section, and just beyond it lies some nodal tissue which acts as the pacemaker for the movements of the stomach.

"3. The gastric section ends at the pylorus, but the pacemaker for the duodenal section is not reached until just above the entrance of the bile duct. This fact is interesting in view of the close functional and pathological relation between the stomach and the acid area of the duodenum.

"4. The duodenojejunal function is marked by another sphincter with its special nerve supply. There are three peritoneal bands lying to the right of the duodenojejunal flexure, each containing a branch of the vagus and splanchnic fibers going to this and the next two sphincters.

"5. The ileocecal valve is really provided with a long sphincter immediately above it, as shown some years ago by Elliot. This is supplied by the second branch.

"6. There is a sphincter with the third of these special nerve supplies in that part of the transverse colon which lies below the pylorus. This marks the end of the part of the colon in which antiperistaltic waves may occur.

"7. At the junction of the pelvic colon with the rectum is another sphincter. This corresponds with the point at which the intestinal contents are held up in a normal person. As soon as the feces pass beyond this point, the defecation reflex should be excited, though if this is neglected the rectum may become unduly tolerant of the presence

of feces, with resulting atony of the rectum, as in one common and troublesome type of constipation.

"8. Finally, the alimentary tract is closed by the anal sphincters.

"This conception of the alimentary tract explains, as we shall see, many of the observed disturbances of the mechanical side of digestion. An irritable focus in any section disturbs the onward progress of the food, by causing a spasm of the sphincter immediately above and often indirectly of sphincters some segments higher up.

"We can express the motor disturbances of the alimentary tract under the heads of irregular and exaggerated contractions, tonic spasms and atony. Irregular and exaggerated contractions are due to irritation of the parasympathetic, and, when in the vagal area, produce colic; when in the pyloric area, tenesmus. Tonic spasm and atony are both due to sympathetic irritation, which may express itself in excess of normal movements—spasm due to constriction of sphincters—or in defect, as atony, due to inhibition of normal movements, as seen in atonic dilatation of the stomach and in intestinal stasis."

As Brown says, "With this general preface we can proceed to discuss certain motor and secretory disturbances of digestion, more especially those associated with the sympathetic nervous system."

Esophageal Spasm. Both motor and inhibitory supply are parasympathetic in origin. Globus hystericus is thought to be spasm of the esophagus in its lowest degree, and one may be able to see an actual point of constriction pass up and down in a kind of peristaltic wave. Spasm may be functional but one should observe caution in making this diagnosis as it is frequently caused by organic disease, and indeed may be the earliest objective evidence of neoplasm.

Cardiospasm. It has been shown that this condition is really not an active spasm of the cardiac sphincter but a failure of the sphincter to relax, and the term "achalasia" has been given it by Hurst. Brown suggests that this reaction of the cardiac sphincter is related to its single innervation by the vagus and the absence of sympathetic supply. An analogy is seen in the spasm in gastric ulcer due to the vagus, for it occurs only in those parts where the sympathetic has only inhibitory fibers. The spasm is mainly protective in nature and may be accompanied by pain, as witness the dyspepsia in hyperchlorhydria.

Hyperchlorhydria means excess beyond 0.2 per cent. after a test-meal, due either to oversecretion of HCl or a delay in emptying, which, by the aid of gastric secretin, increases acidity—in other words, pylorospasm may cause the delay. It is known that acid of itself causes no pain, for even in ulcer cases the administration of acid produces no distress. The pain in duodenal ulcer is relieved by taking food, and it may be argued that this is best explained by the closure of the pylorus shutting off food from the inflamed duodenum. However, the x-rays show that the opposite is true, the stomach is hypertonic and the contents are discharged into the intestine with unusual speed, so that at the time the patient is free from pain food is passing over the ulcer. Furthermore, the stomach does not empty completely in the normal time due to the supervening pylorospasm, and at this time pain returns.

There has been a great deal of controversy concerning hyperchlorhydria. Some have regarded it as purely functional, others (Moynihan) holding it but an expression of duodenal ulcer. Brown says "the truth, as usual, lies between these extremes." A better term than hyperchlorhydria is "reflex dyspepsia" (Craven Moore) and he says the stomach is more often sinned against than sinning. When the stomach attacks are intermittent, the irritable focus is usually outside the stomach. If a patient can eat freely and fearlessly of any ordinary food at times and not at other times, it is usually clear that the stomach cannot be at fault. Such a history should direct attention to the gall-bladder or appendix. Although it is stated that gall-stones may remain for years without producing symptoms, Brown says it is true only if the limiting clause is added "symptoms referable to the gall-bladder."

The general conclusion as to hyperchlorhydria is that it is due to some reflex cause—an irritable focus somewhere lower down in the alimentary canal—and that the high acidity of the test-meal need not necessarily mean oversecretion, but may be due to retention due to pyloric spasm. The more excitable the nervous system, the lower is the threshold stimulus required to initiate symptoms. Inhibition of segments of the alimentary canal and stimulation of the sphincters, both due to the sympathetic play a large part in the production of this type. There undoubtedly exists a simple hyperchlorhydria due to oversecretion and presumably associated with overaction of the vagus, though it is by no means common. When the stomach empties in less than its usual time, and yet the test-meal shows high acidity, there must be both increased secretion and increased mobility, both effects produced through the vagus, and if, in addition to the above, there is no occult blood and the x -rays show no lesion, we are justified in diagnosing simple hyperchlorhydria.

Atonic Dilatation of the Stomach. Just as the sympathetic may cause spasm of a sphincter, so it may produce atony of a segment of the alimentary canal leading to dilatation of that segment. The conventional statement is that atonic dilatation is a sequel of chronic gastritis, but Brown believes it is due to sympathetic inhibition. He illustrates this by a case of a young man who was very nervous at the idea of being called up for military service, and at the time of examination Brown found an atonic dilatation of the stomach which disappeared when the individual learned he would be exempt.

Brown calls attention, in discussing intestinal stasis, to the fact that most of Lane's "Kinks" correspond to those of Keith's "Sphincters" and he suggests the possibility of the symptoms of stasis being caused by muscular spasm of these sphincters as much as by mechanical kinks. These spasms would be produced through the sympathetic, and general sympathetic stimulation would cause not only spasm of the sphincters but inhibition of normal peristalsis in the segments between them, and under such circumstances increased intestinal putrefaction and fermentation would result. Brown has traced, on several occasions, the onset of symptoms attributed to intestinal stasis, to psychical causes, and with the removal of the cause the condition has cleared up. Some

of the worst cases occur in women who have no employment and no object in life. This is the type of case which is benefited by Christian Science, and this undoubted influence of mind on the body is best explained by the action of the sympathetic nervous system, since, through it, depressing and disagreeable emotions inhibit the processes of digestive secretion and absorption while stimulating katabolism elsewhere.

Gastric Ulcer. PROBABLE ENDOCRINE ORIGIN OF PEPTIC ULCER. For the purpose of giving the reader a clear idea of the basis for Friedman's³ experiments, I borrow from his article the admirable summary and critique of the effect of endocrine functioning, which precedes the description of his original work. Neurosis of the ductless glands was first emphasized by Bauer who stated that there are cases of exophthalmic goitre which show the phenomena of that disease, which are not benefited by thyroidectomy, and in which parts of the extirpated gland are found to be normal. The epinephrin poured out from the adrenals during violent emotion may lead to cessation of gastro-intestinal movement, dilatation of the bronchi, increased blood-pressure and glycosuria. Depressive states, in contradistinction to emotional states, may produce suppression of the thyroid and epinephrin secretion, and it seems as if thyroid secretion and epinephrin were intimately associated. The effect of the thyroid is first discussed by Friedman.

It has a double innervation, being supplied by the sympathetic and vagus, and, if the sympathetic element predominates, anacidity or hypo-acidity results. The pure vagotonic type of Graves' disease is rare, but when the sympathetic and vagal stimuli are equal in intensity, hyperchlorhydria is found. Vagal excitation, however, is evidenced in exophthalmic goitre by gastro-intestinal disturbances, vomiting and profuse diarrhea. Exophthalmic goitre is, therefore, a mixed neurosis, the sympathetic influence being seen in the influence on secretion, the vagal influence being manifested in its resultant action on peristalsis. Suprarenal insufficiency is, too, a mixed neurosis, for the sympathetic impulses are diminished and the vagotonic factors increased. In myxedema there is sluggish digestion and gastric atony, and the chemical features of these are anacidity and hypochlorhydria. Evidently diminished vagal excitation. It will be recalled that Lane believes in the influence of subthyroidism as a cause of intestinal stasis. Parathyroid insufficiency seems to have an action on the stomach, as seen in the spasticity in this condition.

In gastric neurosis and in peptic ulcers, hypersecretion and hyposecretion are found. Friedman finds in hormones an action on the endocrine glands. Quoting Mayo to substantiate his credence in his theory—"The curious blending of the sympathetic with the ductless glands is exemplified in the suprarenals, thyroids, and parathyroids. Here we may possibly get an explanation of that close association which exists between pyloric spasm, atonic dilatation, prolapse of the stomach and gastric neurosis." Friedman continues to draw nearer his objec-

³ Journal of the American Medical Association, 1918, lxxi, 1543.

tive, and writes: "The excesses or the deficiencies of products of the endocrine glands producing manifestations of the ductless gland neurosis, passing through the blood-stream, act directly on the muscle, causing pylorospasm, gastrospasm, hour-glass stomach or cardiospasm—various grades of atony. These excesses or deficiencies may also show their effects on minute limited areas of the muscularis mucosæ or the mediums of the vessels producing the ischemia or stasis, either of these conditions leading to circulatory interference and altered nutrition. From these localized areas of ischemia or stasis, lesions occasionally form, probably in the entire intestinal tract as well as in the stomach and duodenum, but, on account of the absence of the hydrochloric acid, ulceration does not occur, at least with the characteristics of *ulcus rotundum*. These latter lesions may become the site of bacterial invasions, as in the appendix, for instance. The bacteria may become pathogenic and lead to a true appendicitis. Aschoff and others do not believe in the bacteriologic origin of appendicitis, and also, according to Hertogué, appendicitis is due to thyroid insufficiency. Further, the frequent association of peptic ulcer, gastric or duodenal, with appendicitis, suggests that appendicitis is due to an endocrinous origin."

That ulcer occurs most commonly in the third decade of life, when neuroses are most common, is suggestive of its cause. Friedman thinks clinical observations prove the frequent coincidence of stigmata in peptic ulcer patients. Animal experiments show that by altering the constitution of the animals by injecting products of internal secretions or by removing parts or the whole of the glands, lesions, erosions and acute ulcers may be produced. Authorities are quoted. Friedman himself has produced acute ulcers in the stomach or duodenum, or both, by extirpating the suprarenals.⁴ He has supplemented this work by injecting pilocarpine (which closely resembles thyroid extract in its action) and was able to produce gastric lesions. The same occurred after parathyroidectomy.

Injections of thyroid were given for several weeks, and the animals suffered from diarrhea, practically after the second injection, as is the case with pilocarpine. With epinephrin there was constipation. In the animals receiving pilocarpine, necropsy showed the stomach in various stages of spasticity, that is, pylorospasm, gastrospasm, hour-glass stomach, and even cardiospasm. In the animals several months after thyroidectomy, the stomach was often markedly dilated without the presence of any obstruction. The stomach resembled the atonic stomach in ulcer cases. Histologically, there was degeneration (fatty) of the musculature near the pylorus. Inferences are drawn between these findings and those seen in thyroid cases, and because of the changes following thyroid and epinephrin injections, Friedman concludes that the hypertonic stomach or the subtonic stomach, in which the presence of an ulcer may be demonstrated, is attributed primarily to a disturbance in the thyroid or suprarenals. If the effect is on minute, localized areas of the organ, ischemia or stasis, as explained, results. The initial lesion

⁴ Quoted in *PROGRESSIVE MEDICINE*, December, 1915, p. 43.

of ulcer gradually develops, and through the secondary factors mentioned, the typical ulcer is produced. I quote verbatim Friedman's conclusions:

"1. The initial lesion of the peptic ulcer is due to vascular changes, such as ischemia or stasis, attributed to contraction or dilatation of limited areas of musculature either of the vessel itself or of the muscularis mucosæ surrounding that vessel.

"2. The spastic or subtonic stomach of gastric neurosis may lead to these vascular changes. The spastic stomach is caused by deficiencies in parathyroid or epinephrin secretions, or by excesses of one or more of the thyroid products. The subtonic stomach is due to deficiencies in thyroid products or to excesses in parathyroid or epinephrin secretion.

"3. The altered peristalsis in peptic ulcer is produced chiefly by glandular neurosis, either in thyroid, suprarenals or parathyroids.

"4. The ductless gland neurosis causes secretory disturbances, either directly or indirectly, by centering its influence on the pyloric or duodenal mucosæ, endowed with endocrine properties.

"5. The functional disturbances in the pure endocrine glands may, in the course of time, lead to actual pathologic changes in themselves.

"6. Acute experimental ulcer after partial parathyroidectomy or partial suprarenalectomy does not show a tendency to heal.

"7. The spastic stomach may frequently be produced experimentally by injections of pilocarpine, whose pharmacologic action is similar to that of thyroid extract.

"8. Atonic dilatation is observed after partial thyroidectomy.

"9. Hydrochloric acid is an important factor in the further development of the acute ulcer from the initial lesion.

"10. Clinical observations in conjunction with experimental findings suggest the endocrine origin of the initial lesion of peptic ulcer."

DIAGNOSIS OF GASTRIC ULCER. Rehfuß⁵ has presented a comprehensive paper on the etiology, diagnosis and therapy of gastric ulcer. The etiologic question is still *sub judice*, and, although Rehfuß discusses it at length, other things in his paper are so much more vital that I have omitted the quoting of his views on the causation of ulcer.

Mechanism of Normal and Disturbed Gastric Function. While this is in the nature of a *résumé* of his previous publications, it may not be amiss to refresh the reader's mind with an abstract of Rehfuß' researches.

1. It must be remembered, in interpreting any curves of fractional analysis, that two or more strictly normal individuals respond differently to a test-meal of the same composition. A certain group will respond with excessive and continued secretion, hypersecretory type; another will be sluggish, hyposecretory type; while another, because it approaches a preconceived notion of what should be normal, iso-secretory type. High acid figures are obtained in health, and in health, too, there is a large group of individuals who have hypersecretion. Each individual has a response to the same stimulant which may be classified in one of the above-named groups.

⁵ Medicine and Surgery, 1918, ii, 603.

2. In health, there are alternate cycles of activity and rest, digestive or interdigestive periods. In the digestive period, psychic stimuli produce a psychic secretion, which is later augmented by the action of secretagogues, hormones, gastrines. The peristole function, active in the interdigestive cycle, is absent. With the onset of peristalsis, there is an increase in acidity, in pyloric and cardiac tone, and, until acidity reaches a certain height, the tryptic regurgitant mechanism, regulating acidity, is inactive. The acidity continues to mount, the food is gradually comminuted by the antrum and the stomach prepares to do its work, specific for proteins, less specific for fats, non-specific for carbohydrates.

In the interdigestive cycle there is approximation of the gastric walls by peristole, and peristalsis has ceased and there are only rudimentary tonal and hunger contractions. The pylorus is relaxed and in more than 50 per cent. of the cases bile is found in the stomach, and instead of many 100 c.c. there are but 50 c.c., or less. The average total acidity instead of 60, 70 and 80 is only 30, while the average free acidity instead of 30, 40 and 50 is but 20. There is almost always trypsin, and the pepsin content is lowered.

3. The highest acidities are seen in health and are compatible with a symptomless stomach. Over 33 per cent. of normal individuals exceed a total acidity of 70.

Diagnosis. This depends on the form, position, and extent of the ulceration. Nearly all the symptoms of ulcer are due to vagotonia, Rehfuß believes. Gastric ulcer offers a very different picture from that seen in health, as regards the digestive and interdigestive phases. In non-obstructive early ulcer, there may be several combinations, the usual phenomenon being, however, a lengthening of the digestive period and a tendency toward continued secretion, even after food has left the stomach. This increases with the severity of the lesion until there is complete ruptured rhythm with absence of the interdigestive period. As regards acidity, it may be stated that the incidence of high acidity in a general run of ulcers is no higher than that seen in health.

In the early stages of ulcer there is little increase in gastric residuum except during the secretory exacerbations. As the lesion becomes older and nearer the pylorus, the residuum increases. Whether there is weakened or delayed secretory response depends upon whether the individual belonged to the hyper- or hyposecretory group and also it depends on the extent, character, and position of the lesion. Lesions on the lesser curvature and in situations other than the pylorus give in the non-obstructive stage a response which is delayed. Lesions near the pylorus are the reverse of this and are accompanied by hypersecretion.

In non-obstructive ulceration there is likely to be a retardive late hypersecretion, with hyperacidity in which the free acid approaches the titer of the total acid. Since this picture is seen in conditions other than ulcer, the curves are characteristic only when in addition to the subjective symptoms there are objective findings, such as occult blood and increase of protein in the gastric contents.

Regarding the finding of blood in the gastric contents, Rehfuß states

that in gastric ulcer, blood is constant throughout the curve, while in duodenal ulcer, blood may be absent in five or six specimens, then suddenly appear coincidently with trypsin.

Eighteen cases, 10 duodenal ulcers, 6 gastric and 2 gastroduodenal ulcers, were studied with the fractional method by Friedenwald and Leitz.⁶ In duodenal ulcer the acidity usually rises higher than in any other condition; it reaches its height rapidly, and the rise is maintained to within a short time of the end of digestion. This rapid rise is rarely observed in cases other than ulcer. In 6 cases the highest acidity appeared after one hour, which illustrates how it would have been overlooked if one had depended upon the usual procedure. Blood appeared in 5 cases, in 4 after an hour, in 1 on the hour. Rapid evacuation of the contents within one and a half to two hours is characteristic of uncomplicated cases of duodenal ulcer.

In gastric ulcer there is no typical curve; in some cases the acidity is quite low; in some normal, but in the largest proportion there is hyperacidity. In 4 cases the highest acidity was found after one hour. Blood is found at times occasionally as occult blood, but frequently it is visible. In Friedenwald's and Leitz' series, blood was found six times, in 4 after an hour and in 2 on the hour. The authors conclude that since the highest acidities would be entirely overlooked if we depended only on the hour extraction, fractional analysis is of great importance in the study of peptic ulcer.

Certain Clinical Aspects of 743 Cases of Peptic Ulcer with Special Reference to the Roentgen-ray Diagnosis. Baetjer and Friedenwald⁷ present a series of 743 cases, and in the table will be found the incidence of important signs and symptoms:

	Group 1. Cases proved by operation.	Group 2. Undoubted cases not proved by operation.	Group 3. Somewhat doubtful cases.	Total.
Definite history of ulceration	185	323	235	743
Pain	163	301	158	622
Pain	169	297	221	681
Tenderness	160	293	188	641
Vomiting	116	208	166	480
Hematemesis	32	67	89	188
Melena	89	155	101	345
Occult blood	103	205	108	421
Normal acidity	54	120	41	215
Hyperchlorhydria	68	95	77	240
Hypochlorhydria	42	62	31	135
Positive x-ray findings	147	272	210	629

The authors discredit the idea that ulcer can be diagnosed from the adherence to the raw surface of bismuth, for the irritability induced by the ulcer produces hypermotility with violent contractions, which prevent the sticking of bismuth to it. At present they lay stress on the behavior of the stomach and intestine, and they believe that the diagnosis of duodenal ulcer is much easier than that of gastric ulcer,

⁶ Medicine and Surgery, 1918, ii, 679.

⁷ Bulletin of Johns Hopkins Hospital, 1918, xxix, 177.

and state that they can practically always exclude the diagnosis of duodenal ulcer in the presence of negative findings, which is not the case in gastric ulcer. In uncomplicated duodenal ulcer, the stomach will empty itself of the greater mass of its contents in from fifteen or twenty minutes to an hour. There is hypermotility, but no tendency to hour-glass contraction. The pylorus is patulous and the bismuth flows quite freely into the duodenum. The latter is in very active contraction and the deformity found in many cases persists throughout the examination.

In gastric ulcer there will be a primary quick expulsion of the contents, and then spasticity returns with hour-glass contraction, and a retention of from four to six hours results. There is, in addition, a filling defect. Great difficulty is encountered when there are adhesions, which mask the usual findings. In doubtful cases of spasm, atropine in full doses should be administered for several days or until the patient is well under its influence.

Gastrectasia due to pyloric stenosis should be readily recognized, particularly when the cardinal symptoms of the condition are present: collective vomiting, peristaltic or antiperistaltic waves, food remnants in the fasting stomach, and especially the three-layered gastric contents containing sarcinae. With the *x*-ray, a typical sack-like formation is observed, and all the bismuth rests at the bottom of the fundus.

In the early stages the physical signs are not marked, peristalsis is usually absent and vomiting, occurring irregularly, is devoid of the usual features seen in gastric stasis. Pain is frequently present, being most intense two or three hours after eating. This is due to pyloric spasm and is temporarily relieved by food or alkalies. The presence of secretion in the fasting stomach is thought by Baetjer and Friedenwald to have much significance. With the *x*-ray we see active contractions with but slow expulsion of the contents. Normally, the opaque meal has left the stomach in three to six hours. Bulging of the stomach just within the pylorus on the greater curvature in the prepyloric region is a noteworthy finding, and is produced by the active contraction of the stomach forcing all the food toward the pyloric region. The pylorus not being patent, the prepyloric portion dilates under the pressure. In early cases this bulging is very slight, but in advanced conditions it may reach the size of an egg, and still later the entire fundus succumbs and a sack-like formation results.

Between *ulcer and carcinoma*, the diagnosis with the *x*-ray is difficult. The following points are to be considered:

1. *Peristalsis*. In ulcer there is always hypermotility with pylorospasm and retention. In carcinoma, unless there be obstruction, there is always hypermotility and rapid evacuation of the contents.

2. *Position*. Ulcer is generally located on the lesser curvature near the pylorus. Carcinoma may occur in any part of the stomach, though invasive lesions are more frequently seen on the lesser curvature near the pylorus and less frequently in the greater curvature. Massive growths are more common on the greater curvature.

3. *Filling Defect.* In ulcer, the filling defect is much smaller and not so apt to have the immediate peristaltic waves interfered with, although, if the inflammatory area be large, there may be a "dead area" surrounding the filling defect. In carcinoma this filling defect is surrounded by an invasive area, producing a large "dead area." In ulcer, there is generally no crater-like appearance, in carcinoma there is this feature.

The authors confess, in the early stages of cancer, to the frequent impossibility of determining whether they are dealing with a malignant or simple ulceration. In their series, 1.1 per cent. of cases of ulcer were mistaken for cancer but, in a larger percentage, carcinoma was mistaken for simple ulceration.

Negative findings are important, too, for if the stomach contents are not expelled promptly and if the greater portion remains after an hour's time, then the trouble is not in the duodenum. The absence of a filling defect in the stomach, or of a deformity of the duodenal cap points away from ulcer. In ulcer there is a spastic retention, and in simple atony and prolapse, despite the retention, spasticity is lacking, and there is no tendency toward the formation of an hour-glass contraction.

The degree of healing can be determined by the *x*-ray for as the ulcer continues to heal the motility of the stomach returns to a more normal condition, and finally the *x*-ray determines when the ulcer is healed. Baetjer and Friedenwald have observed, after an ulcer has completely healed, a new ulcer either at the same location or at another, either in the stomach or in the duodenum. The ulcer must have been caused by a focal infection for after the removal of this noxious focus there was no further recurrence.

Differential Diagnosis of Peptic Ulcer. Attention is properly directed by Cheney⁸ to the fact that the diagnosis of gastric and duodenal ulcer is not made as frequently today as it was a few years ago. This he believes to be due to the more rigid criterion of the present time. The history was considered of special importance and almost diagnostic in the following points: Chronicity, occurrence of remissions, rhythmic cycle of events while an attack persists, influence of eating on the pain, character of the symptoms, heartburn, belching, water-brash, nausea and often severe pain before vomiting gives relief. If to all this there was vomiting of blood, the diagnosis seemed clear. Cheney believes that not every such history means ulcer, and not every ulcer gives such a history. The history in ulcer is nothing but a hyperacidity history, therefore any condition causing hyperacidity gives an ulcer history; furthermore, since not every ulcer case is associated with hyperacidity, no typical history is obtainable. The occurrence of vomiting of blood is too rarely encountered to make it always valuable, and hematemesis may be exhibited in hyperchlorhydria without ulcer.

From the standpoint of physical examination, the second of the triad upon which the diagnosis usually rests, importance has been

⁸ Journal of the American Medical Association, 1919, lxxii, 1429.

placed on its negativity. The only sign we hoped to find was a point of tenderness in the upper abdomen. Tumor, when found, is more likely a malignant neoplasm than ulcer, peristaltic waves across the stomach mean obstruction not ulcer, hence the entire absence of physical signs was a matter of vast importance, but now we know there are several conditions equally negative in their objective expression, for example, obliterative appendicitis, gastroparesis and tabes dorsalis.

The third of the data upon which we have been wont to rely is analysis of the stomach contents, and of this the most characteristic finding is hyperacidity. The latter with a tender epigastrium and a typical ulcer history formed a three-legged stool upon which our diagnosis rested, but we feel today that we know too much about hyperacidity to trust it too far, and we know we have seen ulcer with no hyperacidity as stated above.

Fortunately, the almost universal use of the *x*-ray has taught us so much and from it we have gladly learned a great deal, that no diagnosis today can safely be made without its assistance. Cheney distrusts all other evidence if the radiologist points out no evidence of ulcer, making this reservation, that the roentgenologist must know his technic, be aware of the artefacts which often arise and confuse the reading, and be able to avoid them. "What the clinician wants is roentgenographic evidence, not roentgenographic diagnosis." The clinician cannot afford to interpret as ulcer, apparent defects of the pylorus or duodenal cap, unless other evidence obtainable by him coexists, but he cannot rely on history, physical examination and gastric analysis, for a true diagnosis, and disregard a radiologically demonstrated normal stomach.

1. *Other Conditions Producing Ulcer.* The first in importance is doubtless *chronic appendicitis*, because it so often misleads. The reflex spasm of the stomach arising from chronic appendicitis may cause hyperchlorhydria, but from the history alone, and from the additional help that physical examination offers, we are unable to decide many times between ulcer and appendicitis. If there is definite tenderness, rigidity, muscle spasm and thickening over the appendiceal region, one must have certain suspicions aroused. In any event, an *x*-ray examination is necessary, and if, in addition to a history of hyperchlorhydria, we have the local signs mentioned above, and fluoroscopic evidence of tenderness at the appendix site, delay in the cecum or appendix itself, with evidence of fixation of the cecum to the abdominal wall, then the diagnosis is assured. And almost equally certain is the presence of an ulcer history, negative upper and lower abdominal findings and hyperchlorhydria.

2. *Chronic Cholecystitis.* Here again there is a history simulating that of ulcer, with the addition of a set of symptoms comprising soreness and pain in the right side at the costal margin, a sense of fulness and distention, a feeling of lameness and stiffness on movements of the body involving that side. If the patient has had true colic and jaundice, he is apt to remember both, otherwise lesser manifestations will be unobtainable, the desire of talking about his stomach crowding

out of his memory the points we are most anxious to have recalled. Following an acute attack the characteristic local tenderness, pain and rigidity are helpful, but, between attacks, very little is derived from physical examination. The *x*-ray again comes to our assistance by eliminating evidence of ulcer and demonstrating to us a high hepatic flexure, and stomach drawn to the right, indicating adhesions of the gall-bladder to the surrounding organs from pericholecystic inflammation.

3. *Gastropotosis*. To roentgenology we owe the knowledge of how frequently gastropotosis occurs. The faulty position may cause symptoms of great variety and may exist without symptoms. Nevertheless, when gastropotosis is associated with hyperchlorhydria, symptoms resembling ulcer are produced. Hyperchlorhydria of great degree may occur with ptosis, due to the delay in emptying the stomach because of the drag on the attachment of the duodenum, which cannot descend freely with the stomach even though the greater curvature lies below the pelvic brim. Cheney discredits physical examination in this condition "except for the discovery of a prolapsed right kidney . . . and except after the old method of inflation of the stomach with carbon dioxide." This statement will be questioned by many gastro-enterologists, particularly will it appear unusual to refer to the use of carbon dioxide as a means of determining gastric contour and outline. *X*-rays exclude ulcer on the one hand no matter how firmly established our opinion may be on history, examination and laboratory tests, and it demonstrates gastropotosis with more definiteness than is possible with any method. The limit of normal position may be questioned, but few will deny that a greater curvature below the level of the iliac crests constitutes an abnormal position. However, it must be remembered that symptoms do arise with the stomach higher than this but still ptosed, and, for confirmation of the diagnosis, the therapeutic test of applying a support is recalled. Treatment formerly used for ulcer may, with some degree of justice, be used for ptosis, and it is not at all unlikely that in the past cases formerly called ulcer were in reality gastropotosis.

4. *Gastric Cancer*. When cancer develops on an ulcer, symptoms are confusing, but usually the history is entirely different. In cancer, pain becomes more constant; food is not desired; remedies no longer give relief; food causes immediate distress, and the patient loses weight and color as in no previous ulcer attack. Physical examination is of importance when a tumor is found, but the absence of any mass does not exclude the diagnosis of cancer. Gastric analysis may, or may not, be important, but the *x*-ray rarely, if ever, fails. I should supplement this statement by this one: If cancer is present, the *x*-ray rarely fails to demonstrate its presence, but frequently cancer is diagnosed when there is none present. Recently this belief received support in that a case clinically and by *x*-ray supposed to be malignant proved on operation to be an entirely different condition. Nevertheless, when there is any doubt, exploratory operation is to be recommended, as mentioned by Cheney and subscribed to by all.

5. *Other Intra-abdominal Pathological Considerations.* Intestinal parasites—tapeworms particularly—small hernias, chronic pelvic inflammatory disease and old adhesions should be recognized, although in their symptomatology they bear a close resemblance to ulcer.

6. *Gastric Crises.* History, physical examination and gastric analyses all suggest ulcer, but we should be saved by the x-rays. Even without its help the pupillary signs, reflexes and lumbar puncture should prove of definite assistance. The reviewer has elsewhere reviewed an article by Castex and Mathis ("Syphilis and Gastric and Duodenal Ulcer"), in which it is stated that 100 per cent. are due to syphilis, either acquired or inherited, and the reader is referred to this abstract and also to one by Katayama on Gastric Ulcer in Japan, also to be found in this review, in which it is stated that syphilis was coexistent in 29 per cent. of the Japanese ulcer cadavers. These facts are recalled because it is not unlikely that at times there will be a question whether ulcer and gastric crises of tabes dorsalis are not present in the same individual. Indeed, just such a case was seen and diagnosed some years ago, but so convinced was the surgeon that there was but one diagnosis, "Gastric Crises," that he refused to operate. The patient became dissatisfied, left the hospital and disappeared from view, leaving us uncertain forever after if the diagnosis of ulcer and gastric crises was correct.

7. *Gastric Neuroses.* Cheney considers these conditions as rare outside of text-books. "A history resembling that of ulcer, with hyperchlorhydria, does not occur without some pathological condition somewhere in the body, usually in the abdomen to explain it. In times past this 'acid dyspepsia' has been considered as a possible result of a disturbance of the nervous system only; but such a supposition, with our increased facilities for eliciting facts, is no longer tenable."

PERFORATED GASTRIC AND DUODENAL ULCER. Wood⁹ writes on this question following an experience with 30 cases, 20 being perforations of the stomach and 10 of duodenal perforations. Of the 20 cases, 11 occurred in males and 9 in females; of the 10 duodenal cases, there was only 1 female. As far as age is concerned, the youngest was a girl aged eighteen years, the oldest a man aged sixty-nine years, both gastric cases. Seven of the gastric cases were under thirty years, and 13 over; 3 of the duodenal cases were under and 7 over thirty years. The prognosis is unaffected by the age of the patient.

In 21 of the 30 cases, there was a previous history of indigestion ranging from a few months to ten years. Of the symptoms complained of, pain in the upper part of the abdomen, usually related to the taking of food, was the most common. The time of onset of pain gave no clue to the location of the ulcer. In only 3 cases—all gastric—was there hematemesis.

In 9 of the cases there was evidence that symptoms of indigestion had been more pronounced a few days before perforation. Aggravation of symptoms may be a premonitory sign that perforation is about to occur, indeed this was emphasized by Miles, in 1906. The agency

⁹ Edinburgh Medical Journal, 1918, xx, 358.

causing perforation is undetermined, for, in many cases, perforation occurred while resting.

Perforation is accompanied by agonizing pain which causes him to fall and writhe in agony. The pain is referred to the upper part of the abdomen, but is localized in the region of the ulcer. Thus, in duodenal ulcer the severest pain will be in the upper part of the right rectus. Vomiting after perforation is of little value, as it is frequently absent. There are signs of distinct shock, surface pale and cold and subnormal temperature, but curiously enough the pulse-rate shows little alteration. In 7 cases presenting signs of shock, as indicated especially by a subnormal temperature, the pulse-rate varied from 64 to 96. A stage of reaction supervenes after the first shock, the pain diminishes in severity, the temperature rises to normal and the patient both looks and feels better. This temporary false improvement is probably due to the rapid outpouring of a peritoneal exudate which dilutes the gastric contents. Eleven patients seen at the hospital within twelve hours showed a temperature of 99° F. and over; in 6 cases the temperature was 100° or over, and this elevation of temperature may lead to the diagnosis of acute appendicitis, cholecystitis and the like. It must be emphasized that not too much importance can be attached to the temperature or the pulse in the diagnosis of perforated ulcer.

On examination, the most striking feature is rigidity of the abdomen, which is general and accompanied by tenderness, both being most marked in the upper part of the abdomen. In ulcers in the region of the pylorus, the tenderness and rigidity are most marked over the upper part of the right rectus. When the ulcer is on the body of the stomach, tenderness and rigidity are usually most marked to the left of the median line. In some cases both are most marked in the right iliac fossa, leading to the diagnosis of appendicitis. Alteration in the liver dulness is a sign of little value. Wood lays most emphasis on the following—history of onset of excruciating pain, general appearance of the patient and, of greatest importance, the marked rigidity of the upper part of the abdominal wall.

Hertz¹⁰ devotes twenty pages to the tabulated details and outcome in 60 cases of perforated gastric or duodenal ulcer in the last few years at the public hospital in Copenhagen. The age of the patients ranged from sixteen to seventy-five; only 17 were women. In two-fifths of the 13 duodenal cases no preceding symptoms had been noted before the perforation. The absence of dulness over the liver is an important sign of the presence of air in the abdominal cavity, but in 12 of the cases the liver dulness was practically unmodified. In about 50 per cent. of the cases transient vomiting occurred at the time of the perforation. Two patients presented two perforations and in several cases necropsy showed other ulcers besides the one that had perforated. Petren has reported several ulcers present in 47 per cent. of his cases. The amount of fluid escaping into the abdominal cavity seems to be comparatively immaterial; some of the patients with the larger amounts

¹⁰ Abstract, Journal of the American Medical Association, 1919, lxxii, 386.

recovered. In 12 of the patients the peritoneal contents developed cultures, in all but 1 the staphylococcus was present; 7 of these patients died. At necropsy in all the fatal cases the suture of the perforation had held perfectly; death was due to complications elsewhere. No attempt was made to excise the ulcer in any case. Petren and Rovsing advocate excision, and have reported the recovery of all in their later series of 12 duodenal ulcer perforation cases, including 3 with a chronic fistula and no acute perforation. In only 17 of Hertz's 60 cases was the diagnosis correct when the patient was sent to the hospital; appendicitis was the usual assumption. The outcome of operative treatment was recovery in 75 per cent. of the 19 with a delay of six hours or less; 66 per cent. recoveries among the 12 with interval of from six to twelve hours after the perforation, while only 20 per cent. recovered of the 22 with a longer interval than this. The total mortality was thus 27 out of 53 operative cases, over 50 per cent. He adds that the temperature is not of moment, but a pulse under 90 or 100 is a favorable sign, as is also a sterile peritoneal fluid and good general condition; all the patients with signs of collapse died, as did those with distended abdomen. The operation should be done with the least possible delay, and the field of operation should be walled off from the rest of the peritoneal cavity. The peritoneum should not be rinsed except in the cases seen late, and the same rule applies to drainage. Simple suture of the ulcer seems to be preferable to excision or gastro-enterostomy.

SYPHILIS AND GASTRIC AND DUODENAL ULCER. Castex and Mathis¹¹ do not hesitate to affirm, on the basis of their personal observation, that before the age of thirty, tardy inherited syphilis can be incriminated for 90 per cent. of gastric and duodenal ulcers, and acquired syphilis for the remaining 10 per cent. After the age of thirty the proportions are reversed. A year ago they declared that syphilis was a frequent cause of gastric and duodenal ulcer, but later experience has convinced them that it is the exclusive cause. The gastro-duodenal disturbances begin between the ages of fourteen and thirty-eight years, and males furnish the largest contingent. Severe constipation often accompanies them; possibly the same cause is responsible for both. In one of the 15 cases reported in detail, perforation occurred soon after the first symptoms had been noted; in the others the disturbances had kept up from one to nine years in the 10 cases given operative treatment, and in from three to twelve years in the cases without anatomical corroboration. In every one of the 10 operative cases, the intervention had failed to relieve, but 7 were completely cured with mercurial treatment, and the others materially improved. The operation disclosed in each case an adhesive membranous plastic peritonitis, circumscribed or regional. The disturbances during the first three years displayed a tendency to periodicity. This is a feature common to a number of the manifestations of tardy inherited syphilis. Exacerbation at night is also a feature of syphilitic lesions, and explains the "night pains" with an ulcer in stomach or duodenum. Dieting

¹¹ Abstract, Journal of the American Medical Association, 1918, lxxi, 321.

and medical measures have only palliative action outside of specific treatment. This should not be delayed till irreparable lesions become installed. In diagnosis, the stigmata of inherited syphilis are more reliable than laboratory tests.

GASTRIC ULCER IN JAPAN. Katayama¹² found open ulcer in the stomach in 4.3 per cent., and healed ulcer in 3.98 per cent., in 3942 cadavers at Tokio, including 574 cadavers of children under sixteen years. This is a total of 7.96 per cent., which is a larger proportion than is recorded in European and American cities. It is larger than the 5 per cent. credited to England and Germany, but is less than half of Denmark's 16.7 per cent. The gastric ulcer had been responsible for the death of only 27 of the 314 ulcer cadavers. There was concomitant pulmonary tuberculosis in only 24.2 per cent.; persisting thymus in 7; signs of syphilis in 29¹³ and hypertrophy of the suprarenals in 29.¹⁴ Arteriosclerosis was evident in 45.26 per cent., and valvular heart disease in 21.94 per cent. of the 3942 cadavers, but the relative proportion was less in the ulcer cases. In a fourth of the ulcer cadavers there were multiple ulceration. Males predominated in the ulcer cases, but stenosis of the pylorus was found in only 4 of the 314 ulcer cadavers. This ulceration was usually on the lesser curvature, next in frequency on the pylorus, fundus and corpus; the cardia and greater curvature were rarely affected.

PATHOGENESIS OF GASTRIC ULCER. De Langen¹⁵ discusses gastric ulcer from the standpoint of clinical medicine, emphasizing its extreme rarity among the natives of Java. Examination of the stomach findings in 35 persons at Batavia, healthy or with malaria or other disease, failed to show any deviation from the normal figures in respect to acidity. On the other hand, the predominance of sympathicotonia in the tropics and the absence of vagotonia confirm the theory that vagotonia is the main factor in gastric ulcer, and that the rarity of vagotonia in the tropics is responsible for the infrequency of gastric ulcer.

TREATMENT OF HEMATEMESIS. Bastedo¹⁶ has contributed an admirable paper on the treatment of dangerous hematemesis, treatment based on physiological considerations. Justice can scarcely be done this article in an abstract and for information which seems to the reader to be lacking he is referred to Bastedo's contribution itself.

1. *The Condition of the Circulation.* When hemorrhage has taken place, the fall of arterial pressure is counteracted chiefly by contraction of the peripheral arterioles, as a result of vasoconstrictor stimulation. The cerebral and coronary arteries not being under the control of the vasoconstrictor center, circulation is freely maintained in these vital parts. Consequently, there is no reason for giving cardiac stimulants, such as strophanthus and digitalis, and there is decided contra-indication to such drugs as nitroglycerine to overcome peripheral constriction,

¹² Abstract, Journal of the American Medical Association, 1918, lxxi, 414.

¹³ See Castex and Mathis: Syphilis and Gastric and Duodenal Ulcer.

¹⁴ See Friedman: Probable Endocrine Origin of Peptic Ulcer.

¹⁵ Abstract, Journal of the American Medical Association, 1919, lxxii, 1042.

¹⁶ American Journal of the Medical Sciences, 1919, clvii, 99.

which latter reaction is necessary for maintaining the blood supply to the heart and may be the means of shutting off the bleeding vessel.

2. *The Limit to Hemorrhage.* Far more important than the amount of blood lost is the rate of loss, a sudden loss being more serious than a gradual depletion. About 4.5 to 5.5 per cent. of the body weight must be lost to cause death, but if an illness antedates the hemorrhage (cancer, ulcer, hepatic cirrhosis), the fatal amount will naturally be less. But if the hemorrhage recur at several hours' interval, the total fatal amount will be more, for the blood volume tends to be restored by absorption of tissue fluid, and the blood-forming organs rapidly furnish blood cells.

3. *The Cessation of Bleeding.* The natural check comes from obliteration of the bleeding vessel, most effectively accomplished by clot formation. This thrombus does not form at once in the opening of the vessel, because of the force of the blood flow, but begins at some distance, and by accretion reaches back until it closes the opening. The distance at which the clot begins to form depends on the local force of blood flow, and on the degree to which the blood is held in contact with the injured tissues. Therefore gastric hemorrhage is apt to be profuse, for the stomach being a hollow viscus a great deal of blood may spurt out before any clings to the tissues in the neighborhood of the bleeding-point. Contraction of the stomach, therefore, is a *sine qua non*. Factors which interfere with clot formation are: (a) active peristalsis; (b) undue increase of blood-pressure due to accelerated respiration and increased heart-rate; (c) sudden accesses of blood-pressure, induced by vomiting and rapid intravenous administration of large amounts of fluid; (d) injudicious lavage.

To favor clot-formation, we require a quiet contracted stomach, quiet heart and respiration, avoidance of vomiting and careful administration of fluids to restore blood volume. Morphine and strychnine are indicated, strychnine, Bastedo remarking, not being a circulatory activator. Lavage is indicated only when the stomach remains distended and if the bleeding still continues, otherwise leave it alone. Emetine is useless; it is a depressant of the vasoconstrictor center and it retards clotting by causing a deficiency in the fibrinogen of the blood.

4. *Venous Hemorrhage.* This is of small force and usually quickly ceases, unless there is portal congestion in which case the portal venous pressure exceeds 10 mm. of mercury and bleeding is more vigorous and more prolonged. In hematemesis of portal congestion, lavage is absolutely contra-indicated, on account of the probability of submucous esophageal venous dilatations.

5. *Measures to Retard the Ejection of Blood.* Epinephrine acts locally to constrict the bleeding vessel and permit of clot formation. It is given in amounts of 4 to 15 c.c. of the 1 to 1000 solution of the hydrochloride, diluted with about two to five times the amount of water to provide bulk enough to coat the stomach. Its disadvantage is that it induces peristalsis. Intravenously it cannot be used because of its hypertensive action. Colloid materials, gelatine and acacia, sub-

cutaneously or intravenously, increase viscosity and act mechanically to retard the escape of blood.

6. *Measure to Increase the Blood Coagulability.* There is a natural progressive increase of the blood's clotting power as hemorrhage continues, and Bastedo says, "Indeed so strikingly does hemorrhage tend to cease at the point of syncope that Crile has advised a return to the method of the older physicians who would set the patient up and perform venesection to hasten the onset of syncope." The clotting elements in the circulating blood are prothrombin, calcium and fibrinogen and some thrombin. The ant clotting elements are antiprothrombin and antithrombin. In clotting, the prothrombin is liberated and takes up calcium thereby changing to thrombin, and this precipitates the fibrinogen in the form of fibrin, and clotting is accomplished. In the circulating blood, clotting is prevented by the ant clotting elements, holding the prothrombin and thrombin in neutral combination. Normally, there is a great excess of anticoagulants. In hemorrhage, the disintegrating platelets and leukocytes and the tissue juices supply the lipoid thromboplastin (cephalin, cytozyme, thrombokinase) and this breaks up the prothrombin combination, sets free the prothrombin to unite with calcium, fibrinogen is coagulated and the clot is formed. The principal coagulants in use are: (a) cephalin or thromboplastin; (b) blood platelet extracts; (c) blood serum, the serum derivatives, euglobulin, coagulose and defibrinated blood; (d) whole blood. These coagulants are naturally more valuable in continuous small hemorrhage, or in preventing a recurrence of profuse hemorrhage, and being but short-lived must be repeated frequently.

Cephalin acts by taking up the antiprothrombin and antithrombin and setting free the prothrombin and thrombin. It is marketed as Thromboplastin-Hess and Kephalin. The former is a solution in Ringer's solution of brain tissue juice with a fine suspension of brain tissue. It is preserved by 0.3 per cent. trikresol, and may be sterilized by boiling. The dose is 4 c.c. in 15 c.c. of water every half hour for three or four doses by mouth, but it is used subcutaneously or intramuscularly in 10 c.c. doses. Kephalin is an ether-acetone-alcohol extract of brain evaporated until the yellow fatty or lipoid residue remains. By mouth or intramuscularly its dose is 10 to 30 drops in salt solution repeated every six or twelve hours. Intravenous thrombosis is a danger in the intravenous route, and it should never be used in this way.

Coagulen is a powder prepared from blood platelets by fractioned centrifugation, followed by dessication and dilution with lactose—1 gram represents 20 grams dried blood. It is readily soluble in water and may be boiled. Twenty to 60 c.c. of a 10 per cent. solution may be given by mouth, never intravenously.

Blood serum is a plasma minus blood cells and coagulative elements of the clot, and has lost part of its power to induce coagulation. It has prothrombin and thrombin in combination with antithrombin, but lacks fibrinogen. It is not a powerful coagulant even in amounts up to 200 c.c. or more given intravenously. It has a certain value, how-

ever, but has the great disadvantage of exposing the patient to the danger of anaphylaxis through its high percentage of protein (6 to 7). It rapidly deteriorates, and, if fresh serum is to be used, it takes from two to twelve hours to obtain it from blood, and from twelve to twenty-four hours for it to influence clotting.

Euglobulin. This has a smaller amount of protein than blood serum, but does not retain its potency for any length of time and is not marketed at present.

Coagulose is a precipitate of horse serum, obtained by a mixture of acetone and ether. It is prepared aseptically and may be obtained in sterile tubes of 0.65 grams; 8 c.c. of sterile water, 40° C., are added and it is ready for use.

Calcium is futile in these cases, as to be effective it must be given for many days in large doses.

Styptics are irritant and tend to cause excessive peristalsis, nausea and vomiting and should not be used.

7. *Measures to Restore the Blood Volume. Transfusion.* This is the best method of treating hemorrhage, for it fills the vessels with a liquid of the same physiological nature, prevents lowering of viscosity and is not readily lost from the vessels by osmosis. Transfusion should be performed if systolic pressure drops to 70, regardless of hemoglobin. Bastedo transfuses regardless of either, if the hemorrhage seems to be continuous or recurring in small amounts.

Other Liquids. Salt solution (1000 to 1200 c.c.) administered slowly by rectum, by hypodermoclysis or by vein. The disadvantages are that these liquids do not increase the volume of the blood elements, they decrease viscosity and change its osmotic tension. If the blood-pressure is very low, pituitary or adrenalin, 1 c.c., may be added to the saline. To increase viscosity, acacia 5 per cent. in Locke's solution, or 1 to 2.5 per cent. solution of gelatine in saline may be used. The latter may be used subcutaneously—400 c.c. of a 10 per cent. solution.

8. *Other Mechanical Measures.* Bastedo recommends bandaging the limbs, raising the foot of the bed, keeping the body warm; in addition binding the abdomen tightly and putting weights upon it has been suggested by Meltzer. Ice-bag to the abdomen is a customary practice, but Tice and Larsen claim that it does not constrict the splanchnic arterioles.

9. *Surgery.* Not indicated in acute hemorrhage, for "as a matter of fact, either spontaneously or because of, or in spite of, the medical measures employed, nearly all hemorrhages cease and are not fatal. So that by the time we have decided that the hemorrhage is not going to cease the patient is beyond the point of safety for an operation."

Gastro-enterostomy. Performing gastro-enterostomy in 116 cases with but 2 per cent. mortality is the proud achievement of Stretton,¹⁷ and in deciding upon operation it is almost a negligible factor. In cases of pyloric obstruction, he says surgical treatment is far better

¹⁷ British Medical Journal, January 4, 1919, p. 5.

than dilly-dallying with medical treatment, a statement no one will controvert and a statement which amounts almost to a truism. I believe it is the conviction of almost any internist of experience that this condition warrants operation, even without waiting until "you find that medical treatment fails," as suggested by Stretton.

The occurrence of a secondary peptic ulcer in the jejunum following an operation performed two years before is the text of an article by Carnot, Froussard and de Martel,¹⁸ and after reading his article I believe the most interesting point he makes is this: "The occurrence of secondary peptic ulcers shows how important it is not to let patients with gastro-enterostomy go their way without medical supervision. They should receive a carefully regulated diet, be continuously under observation, so as to prevent, if possible, any abnormal actions of the gastric juice in the jejunum."

Before quoting Hutchinson's paper, it is interesting to see how gastro-enterostomy is regarded by a South American colleague. It appears that there is a wave of reaction extending over the medical profession, with regard to the unfulfilled promises of gastro-enterostomy and a decided reaction against the indiscriminate use of this important surgical measure. Udaonda¹⁹ reports the remote results in 22 out of 71 operative cases of simple, uncomplicated gastric ulcer followed for from one to four years. Only 27.24 per cent. are free from stomach disturbances, all the others have had the old subjective symptoms return as severe as before, and as rebellious to treatment. The symptoms returned after intervals ranging from three months to two years; the average between the sixth and tenth months. There has been hematemesis in 16 per cent., and occult blood has been found in over 86 per cent. The gastro-enterostomy opening seems to be working perfectly in all. Only in 1 case is there suspicion of syphilis and there is nothing to suggest jejunal ulceration in any case. In his non-operative cases, fully as good results were obtained with medical treatment alone. These cases of Udaonda's seem to be the kind of cases described by Hutchinson in his able article under the heading "Functional Disorders."

*Disappointments after Gastro-enterostomy.*²⁰ (a) *Persistence of Pain.* Pain being the chief symptom of ulcer, it is the most certain symptom to disappear after gastro-enterostomy. In many cases the relief from pain is permanent but in a few it returns after a variable interval of time, and the patient fears he has a return of the ulcer, which, as a matter of fact, is a rare occurrence. Hutchinson advises against the rather glib diagnosis of adhesions, which should not form after gastro-enterostomy, and says that in such instances, where pain reappears, the formation of an ulcer either in the jejunum or at the site of the anastomosis should be suspected.

Jejunal ulcer is most likely to form where gastric hyperacidity persists in spite of the operation, whereas an anastomosis ulcer results from

¹⁸ Bull. de la Soc. méd. des hôp., December 13, 1918, p. 1173.

¹⁹ Abstract, Journal of the American Medical Association, lxxi, 1619.

²⁰ Hutchinson: British Medical Journal, May 3, 1919, p. 535.

using unabsorbable sutures when uniting the stomach and jejunum. Although medical treatment of rest, diet and bismuth, brings about temporary healing, the most satisfactory result is obtained by operation. It should be remembered that pain is not always a sign of ulceration occurring after gastro-enterostomy, but may be caused by extragastric conditions; notably gall-stones. Appendicitis should be borne in mind as a possible cause, but surgeons nowadays include appendectomy when performing gastro-enterostomy; however, if the appendix, for any reason, has not been removed, the condition must be remembered as a possible cause of trouble. Kidney stones are prone to occur in patients who have taken large quantities of alkalies, and phosphaturia is not at all uncommon, and, with this, phosphate deposit in the kidney. An anastomosis between the stomach and the jejunum predisposes to pain in the colon due perhaps to too rapid filling of it, and perhaps due to irritation from too imperfectly digested food. Abdominal pain with looseness of the bowels is not uncommonly encountered, and even mucous colitis.

(b) *Vomiting.* This is less frequently a cause for disappointment than is pain. Formerly due to a vicious circle, this, now, is rarely the case, as a vicious circle is rarely established with the present methods of operating. When vomiting is complained of, it consists mostly of bile, and generally indicates a mechanical obstruction in the neighborhood of the anastomosis. Should gastric lavage fail to give relief, surgical measures should be considered.

(c) *Functional Disorder.* There is a certain class of patients presenting, after operation, no organic or surgical lesion, but symptoms of a profound functional disturbance of the alimentary tract. These symptoms comprise heaviness or distention in the epigastrium, emptiness as if the food dropped "straight down," nausea or constant "sea-sickness," flatulence and regurgitation, and, in addition to these, there may be a feeling of great weakness and prostration, failure to gain weight, profound mental depression with marked nervousness and phobias of many varieties. The cause of these distressing complaints is difficult to recognize; a test-meal reveals the usual subacidity of a gastro-enterostomy; x-ray examination shows good emptying. Occasionally stagnation in the lower portion of the stomach is seen due to the placing of the stoma too high, and especially is this seen if the pylorus is occluded at the time of operation. Almost all of these functional cases exhibit diminished gastric tone with ileal stasis.

Treatment. Not very much can be done, according to Hutchinson, but much relief can be given by an abdominal support and a dry diet with rest after meals. Abdominal massage may have a good effect upon the stasis. Drugs are of little use. Closure of the anastomosis by surgical measures may even have to be done, although reluctantly, and when Hutchinson has found this to be necessary, great relief to the patient was experienced, although *not* restoration to perfect health.

The moral which our author draws from his experience is that cases for gastro-enterostomy should be selected with great care, and the coöperation of a physician should be obtained. Moral courage on

the part of the surgeon demands that he close the abdomen and proceed no further if no definite lesion of the stomach or duodenum can be demonstrated.

These papers have a particular interest for the present essayist, as three years ago he and Speese²¹ urged the close coöperation of the physician and surgeon in the after-treatment of patients operated upon for diseases of the gastro-intestinal tract, believing that only by such coöperation could unfavorable results be avoided. No patient is cured at the end of a month's sojourn in the hospital, after undergoing a gastro-enterostomy. He is not perfectly well, he cannot eat with impunity whatever he desires, he cannot do with safety everything he wishes, and for a long time during the reconstruction or readjustment period he should be regarded as a patient and treated as such. Censure for failure to achieve ultimate success in these cases may be directed at the surgeon, at the physician and at the patient, but least of all at the last-named if a rigid follow-up system is practised. When all conditions of this system are met, there will still remain, of course, a group of patients for whose ill-health and persistence of complaints no one can be reproved. In the cases which Speese and the writer have studied and treated together, we have been repaid for our continual coöperation by uniformly good postoperative results.

Each patient should report at regular intervals to his physician, even though he believes himself to be in perfect health. These intervals may vary, but they should be every two or four weeks, or oftener, if the patient complains of any discomfort. At these visits a thorough history should be taken as to the physical state of the patient during the days and weeks preceding the visit, and a physical examination should be made each time. Questions should be searching and should primarily be directed toward the symptoms of the original complaint. The blood-pressure, pulse-rate, body weight, the blood, urine and feces should be regularly examined. No case of gastric or duodenal ulcer is to be considered cured so long as blood is found in the stools, using careful tests, provided exogenous sources of blood have been eliminated. So long as blood is present, the patient should be treated as an ulcer case. If blood has been absent and again reappears, the above still holds good. Blood is frequently found when the subjective state seems to the patient to be perfect, but nevertheless occult blood found after a meat-free diet cannot be disregarded.

Carnot, Froussard and de Martel and Hutchinson emphasize medical supervision throughout the course of the case, and it is a point which cannot be too strongly emphasized.

We have read with interest, and recommend its perusal, a paper dealing with the surgical side of the vicious circle and the ways of avoiding or correcting it. The article is by Vulliet.²² It will be probably discussed in the appropriate section of *PROGRESSIVE MEDICINE*, but reference is made here for those who may be interested in the question of failure after gastro-enterostomy.

²¹ *Pennsylvania Medical Journal*, May, 1917, p. 546.

²² *Revue médicale de la Suisse romande*, 1918, xxxviii, 673.

Gastric Secretion. POSSIBILITIES OF FRACTIONAL GASTRIC ANALYSIS. Fractional gastric analysis has for its purpose the determination of gastric digestion, and it may be definitely stated according to Rehfuß²³ that, owing to the very marked changes which may occur in comparatively short intervals, an examination of any single phase of the digestive curve gives no information as to what has preceded or what will follow that phase. Human gastric digestion is divided into a series of recurring cycles which he calls digestive and interdigestive cycles. The digestive cycle is that portion in response to the ingestion of food of any kind that evolves in a perfectly coördinated manner. There are well-marked psychic and chemical phases, the psychic secretion being considerable (250 c.c.) lasting from sixty to eighty minutes, and being affected by changes in environment, fatigue and many factors. The total acidity of this phase is 97.2 and is diminished by atropine. The chemical secretion commences early, reaching its maximum later and thus completes digestion. It is during this active period that there takes place the inauguration of peristalsis and a change from the resting secretion to one of much higher acidity. Following the digestive phase comes the interdigestive phase, which is characteristic of normal digestion. The stomach is never empty, but this resting secretion is different from the digestive secretion, being only 50 c.c. with acidity of 30 and free acid of 18; furthermore, bile is present in 50 per cent. of the cases and there is constant tryptic regurgitation. There is no peristalsis, but, instead, we have hunger contractions and a relaxed pylorus.

There is no one form of normal curve, and it must be emphasized that no acid figures occur in diseases that may not be duplicated in health. Forty-five per cent. of normal individuals showed total acidity above 100, and 42 per cent. of ulcer cases showed the same thing. Furthermore, about 40 per cent. of normal persons show hypersecretion.

In disease, every variation may occur, but it may be emphasized that at certain phases certain acidities and quantities of secretion are normal and at other phases these same figures are abnormal, which apparently is of value. For example, after an Ewald meal with the peak, in health, at the one hour and one hour and a quarter point, there may be a total displacement of the curve, showing either an exaggerated phase during the first hour or a slow initial phase, followed by pronounced findings at the end of the second hour. In pathological cases there may be: (1) a delay in digestion; (2) an acceleration in digestion; (3) a disturbance in secretory velocity resulting in hyposecretion or hypersecretion; (4) alteration of digestion by the addition of frankly pathological products, such as blood, pus and mucus.

"We recognize that alterations may come through the systemic circulation (soluble toxins, bacteria), blood dyscrasias, resulting in altered mucosal conditions and altered secretory digestion, or through disturbances in the portal circulation (cirrhosis). These systemic conditions may stimulate or depress secretory activity. Again, we know definitely that a lesion elsewhere in the gastro-intestinal tract (gall-

²³ Journal of the American Medical Association, 1918, lxxi, 1534.

bladder, appendix) may increase the irritability of the vagus, inducing the secretory manifestations of vagotonia. In chronic gastritis we recognize as operative not merely the inability of the mucosa to form a complete secretion, but also the mechanism of neutralization of the secretion by the mucus. In ulcer we do not look for pathognomonic curves, for we realize that a non-obstructive ulcer gives a very different picture from pyloric stenosis with ulceration. In all forms there is a tendency toward vagotonia, pylorospasm, hypersecretion, shortening of the interdigestive period, and increase in protein content. In duodenal ulcer, the most characteristic finding is that of positive blood at the phases of tryptic regurgitation. In a large group of duodenal ulcer cases, there is present a late hypersecretion, accompanied by periodic regurgitation of duodenal material giving occult blood reaction. Gall-bladder disease gives clean digestion and often high acidity without mucus, pus or blood, and when there is pericholecystitis, with adhesions to the duodenum the adhesions closely resemble stenotic ulcer at the pylorus. However, there is a group of old gall-bladder cases associated with duodenitis, in which a low curve, with all the findings of true gastric infection, may be detected. Appendicitis is most frequently accompanied by clean digestion, with high figures indicative of vagotonia. Cancer has as its characteristics the uniform and constant depression of secretory activity, together with the presence of its specific products, pus, blood, mucus, lactic acid, soluble protein, etc., each of which plays a part in the composition of the curve that is formed. These facts must be borne in mind. Nerve factors, circulatory toxins, the lack of building material, and direct local disease of the mucous membrane may all produce low acid curves, but they produce the curves very differently. The first and second each give a clean subacid curve, and the third is accompanied by elements such as mucus, pus and blood, which give a clue to its source. Let me illustrate: We can see in a certain anemia a low curve without any mucus, blood or pus; it is simply a subacid curve in anemia. The subacid curve in chronic gastritis is punctuated by the periodic secretion of quantities of mucus. In infectious gastritis, there is not merely mucus, but bacteria, pus and blood, and the same is true of carcinoma. Pericholecystitis, with adhesions to the duodenum, may give the same picture as contrasting pyloric ulcer, but blood and increased protein in the latter serve to distinguish it. We know that gall-bladder disease, appendicitis, pancreatitis, intestinal adhesions and pelvic disease may all give reflexly vagotonia and the same gastric picture. It is the correlation of all the data which enables us to make the correct interpretation."

GASTRIC SECRETION IN THE FASTING STOMACH. Because of the divergent opinions regarding the condition or existence of the gastric juice in the fasting stomach, Ramond and Robert²⁴ have reported the results of their studies of the normal and pathological stomach. Four apparently healthy soldiers were examined, and gastric juice of rather

²⁴ Bull. de la Soc. méd. des hôp., December 6, 1918, p. 1134.

high acidity was obtained, but later it was found they had eaten something and eventually when they were more closely guarded against this mischance no juice was obtained. The authors make the interesting observation that when the diet is animal in character, no juice is found in the fasting stomach, but when the diet consists of milk and vegetables, gastric juice is regularly demonstrable. They are now speaking of normal cases.

In a group of dyspeptics, exclusive of pyloric stenosis, ulcer, or cancer, no constancy of results was obtained, and a meat diet sometimes increased and sometimes diminished the amount of juice and of hydrochloric acid. In mild dyspepsia, from 20 to 50 c.c. were obtained, but these figures are probably too low as it is impossible to empty the stomach completely. Beyond 100 c.c. one should think of the possibility of stenosis, spasmodic or cicatricial, and Ramond and Robert urge that gastrosuccorrhea does not exist without ulcer. Also an appreciable quantity of gastric juice is found in more or less ptosed stomachs, while tonic or hypertonic stomachs rarely contain more than 20 to 30 c.c.

The color of the juice is variable, sometimes colorless or opalescent, at other times, slightly yellow from the admixture of bile, and again greenish in appearance. With the last described appearance, the gastric juice is strongly acid. The fluid is always more or less viscous, containing particles like rice grains, the number of these grain-like particles being in some way connected with the degree of gastric acidity—a strongly acid juice contains no grains, while a weak secretion holds a great many in suspension.

The inference drawn from this paper is that in healthy individuals the previous dietary has a great influence; individuals who are carnivorous show no juice in the fasting stomach, those who are herbivorous always show a certain amount. In the majority of patients with gastric disturbances there is always a fasting secretion, but this secretion has little significance unless it is profuse, continuous and unaffected by nourishment. Our own authorities, among them Rehfuess and Carlson, have pointed out the presence of continuous secretion in the normal empty stomach, but I remember no suggestion that previous diet may influence the amount. Clinically, of course, it matters little if secretion is recovered fasting, the main significance, as emphasized by Carnot in the discussion of Ramond's and Robert's paper, attaching itself to the amounts recovered, which in health rarely exceeds 25 c.c., a figure given by Carlson.

EFFECTS OF HYDROCHLORIC ACID THERAPY ON HYDROCHLORIC ACID OF THE STOMACH. In an earlier paper abstracted in *PROGRESSIVE MEDICINE*, December, 1918, p. 34, Crohn² reported some studies undertaken to understand more clearly the effect of antacids on the acid output. In the paper at present under consideration, the question of acids is taken up. Fractional analyses were made, after administering hydrochloric acid with the view to determining the best method of

giving it for therapeutic purposes. As Crohn rightly says, there is no uniformity of opinion regarding the dosage, the time and the frequency of administration of the acid, nor has he found any scientific work which pertains to this question. A review of the literature, as concisely given by Crohn, makes it only too apparent that a wide latitude of opinion exists and it is because of this that Crohn has undertaken rather exhaustive studies.

In order to study the effect of a single dose of acid, cases of achylia and cases of pernicious anemia were chosen. In all these cases, fractional analyses revealed no free hydrochloric acid. Control examinations were, of course, made. In Fig. 1 is shown the effect of giving 40 minims of dilute hydrochloric acid to a case of pernicious anemia after the stomach had been aspirated. The titration at the end of twenty-five minutes was identical with that of the fasting residue before the administration of the acid. Crohn concludes that hydrochloric acid administered therapeutically to the fasting stomach promptly disappears from that organ, the last trace leaving within twenty-five minutes.

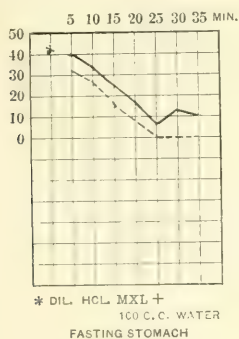


FIG. 1

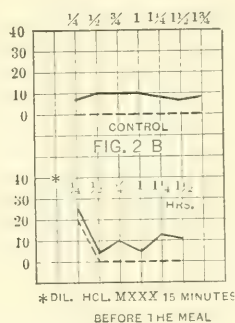


FIG. 2

Upon a case of achylia gastrica, several experiments were performed. In Fig. 2 the effect of giving 30 minims, fifteen minutes before the oatmeal gruel test-meal, is shown. The free and total acidity were immediately 20 per cent. and 24 per cent. respectively. At the next titration, fifteen minutes later, free acid had disappeared and total acidity was only 4 per cent. During the subsequent period, the curve was identical with that of the control. The conclusion is that acid given before a meal exerts no influence on the acid secretion of the subsequent digestive cycle. In Fig. 3 dilute HCl (30 minims) was administered with the gruel. A slight increase of acidity was noted during the first half hour of digestion, thereafter a return to the level of the control curve was noted. The conclusion drawn is that the administration of acid with a test-meal is of advantage only for the first half hour.

Twenty minims of HCl were then administered, fifteen minutes after the test-meal (Fig. 4). There was a complete failure to relieve the con-

dition of anacidity, at no time was there any free HCl in the contents. Hence it seems that there is a difference in titer between 20 and 30 minims of acid and also a difference depending on the time the acid was given. Crohn, it seems to me, has not correctly stated the results of his findings, for under experiment 3 he states, "the therapeutic administration of acid with a test-meal is of advantage only for the first half

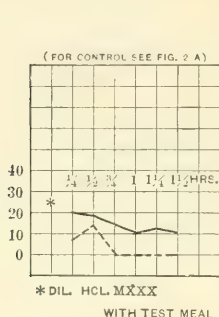


FIG. 3

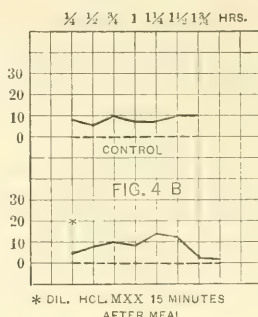


FIG. 4

hour," and under experiment 4, he remarks, "Twenty minims of dilute hydrochloric acid failed to improve the condition of anacidity when given with a test-meal."

In experiment 5 the conditions were the same as in experiment 4, except that the dose of the acid was double—40 minims—and this experiment was repeated with 3 cases of achylia gastrica. Figs. 5 and 6 show more favorable results, although the increase was but temporary, being limited to the short period directly following the medication.

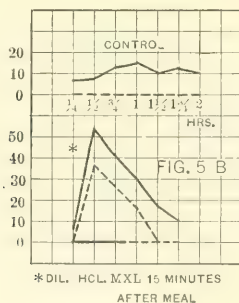


FIG. 5

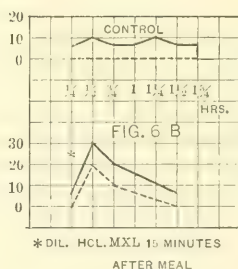


FIG. 6

Ten c.c. of decinormal HCl were administered to a patient one and a half hours after the ingestion of the usual test-meal (this dose corresponds to 5 minims of the dilute HCl), but there was no effect on the acid curve. When 50 c.c. were used (corresponding to 25 minims of dilute HCl), there was a slight increase in both free and total acidities, the increase being 54 per cent. in total acidity, and being maintained to the end of digestion.

In Fig. 7 are the results of giving 10 minims every half-hour during digestion. It will be seen there is a definite increase in acidity throughout the digestive cycle, although free acid was absent. Motility was slightly accelerated. In Fig. 8, 10 minims were given every fifteen minutes during digestion. Following this method of administration there was a noteworthy increase in total acidity and also increase in free acid. The motility of the stomach was unchanged.

The striking fact in these experiments is the rapid disappearance of the acid that has been given. Evidently the stomach quickly expels the acid through the pylorus in much the same way as water is evacuated. Another fact is that the titer which is obtained immediately after introducing the acid is not maintained, but is neutralized or diluted. The means whereby neutralization is effected are two, (a) secretion of a watery gastric juice that contains no acid ions, (b) mucus.

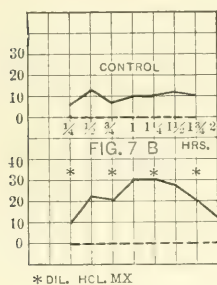


FIG. 7

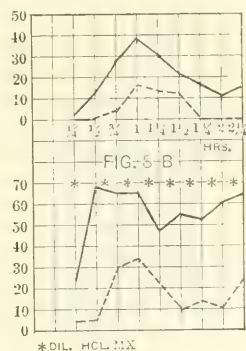


FIG. 8

Crohn believes that the customary method of administering hydrochloric acid, in a single dose, is inefficient, and the preferable way is to give it in small doses at frequent intervals. The effect of acid is a purely chemical one, as in none of the experiments was there evidence of mucosal stimulation.

INFLUENCE OF ORGANIC EXTRACTS ON GASTRIC SECRETION.²⁶ The thyroid gland evidently stimulates, and the adrenal inhibits, gastric secretion. These effects are apparently produced chiefly through the intermediation of the vagus and sympathetic nerve terminals. The secretory functions of the vagus are apparently excited by some material which can be extracted from the thyroid by alcohol or by a process which involves more or less hydrolysis of the gland. The inhibitory powers possessed by the sympathetic terminals seem to be excited by all the extracts from the adrenal gland which were tested. Extracts from the entire gland are much more active than adrenalin. Can this activation or inhibition of the secretory cells of the stomach through their nerve supply in conjunction with thyroid and adrenal products be a process which is essentially one of nutrition? A prolonged stimulation

²⁶ Rogers, Rahe and Ablahadian: American Journal of Physiology, 1919, xlviii, 79.

like that produced by the thyroid extracts, when compared with the increased general metabolism which follows thyroid feeding, suggests that the thyroid product, with the intermediation of the vagus or secretory nerve impulse, increases the metabolism of the gastric epithelium. This means that it facilitates the absorption of nutritional material or "food" by the cells and the metamorphosis of this "food" into the cell's secretion. The adrenal product, on the other hand, in conjunction with the sympathetic or inhibitory nerve impulse, can be imagined as preventing this metamorphosis. The nature of the impulses conveyed to the stomach by its double nerve supply is, of course, unknown, but, as determined by electrical stimulation, the vagus evidently activates and the sympathetic inhibits this organ. If the thyroid product has an affinity for the vagus terminals and promotes cell metabolism, and the adrenal an affinity for the sympathetic and retards this metabolism, then it is unnecessary to imagine two radically different kinds of nerve impulses. The chemical properties of the nerve endings are alone to be considered. The nature of the impulse in the vagus and the sympathetic can be the same, but the effects of its discharge from one nerve terminal or the other are regulated by the presence and amount of thyroid and adrenal, and probably many other products.

EFFECT OF WATER DRINKING ON GASTRIC ACTIVITY. Ivy²⁷ has studied this subject, restudying some of the problems investigated by Reh fuss and his collaborators, with the following conclusions: When water is taken with the meals the amount of the gastric juice is increased and with this increase rises the free and total acidity. The emptying time of the stomach is, however, decreased, due probably to the dilution of the gastric contents. The emptying time for water ranges from 100 to 400 c.c. in fifteen minutes. Ivy was unable to demonstrate any fatigue of the gastric glands when stimulated by water.

GASTRIC HYPOMOTILITY. In the present paper, Levy²⁸ refers to a previous article on gastric motility which was reviewed in *PROGRESSIVE MEDICINE* for 1916, December, p. 66, an able article, of which the present one is in the nature of a complement. I called attention to the dissimilarity of opinion between Levy and Kantor on the one hand, and Carman and Miller on the other, regarding the value of the *x*-rays in testing gastric emptying, a difference of opinion still maintained by Levy. He contends there is no uniformity of technic employed by roentgenologists. There is a marked difference in the kind and quantity of the opaque salt which is used. The vehicle is sometimes liquid, like buttermilk or cocoa; sometimes more solid, like bread and milk or cereal. There is no constancy in practice concerning eating between the first and sixth hour observation, nor is the stomach always emptied previous to beginning the examination. Levy recommends that the technic of the opaque meal be standardized as in the Boas meal.

Levy uses the following method: After a complete history and physical history and physical examination, the patient presents himself in the morning, fasting. The tube is introduced and the contents aspi-

²⁷ American Journal of Physiology, 1918, xlv, 420.

²⁸ American Journal of the Medical Sciences, 1918, clvi, 795.

rated. The Ewald test-breakfast is then administered, and the contents aspirated. The roentgen-ray examination follows. The meal for this consists of 100 grams of barium sulphate in 500 c.c. of buttermilk. The usual fluoroscopic and radiographic examination is made and the patient instructed to return in six hours and warned not to drink or eat anything in the interval; on the following day he is required to eat a regular meal consisting of meat, potato bread and some light dessert, the quantity to correspond with what he usually consumes for dinner and to present himself seven hours later, not eating or drinking in the interval. The object of the visit is not disclosed so as to eliminate the psychic factor. The tube is then introduced, the contents aspirated and the stomach washed out. As the stomach should be empty at this time, the amount of residue determines the degree of motor disturbance.

Of 1000 new cases studied since Levy's first paper, 141 were found to be hypomotile with the tube and 100 with the opaque meal. In no instance did he fail to find some food in the stomach when the opaque meal was visible six hours later, but in 41 cases the tube disclosed delayed emptying when the *x*-ray was negative. As a rule these cases were of the milder forms of motor disturbance, but of these there were 9 with a typical duodenal ulcer history (two were verified at operation); one case of gastric ulcer (operation); 8 cases of chronic appendicitis (4 operations). Levy believes chronic appendicitis is very frequently associated with a mild form of hypomotility sufficient to give a moderate seven-hour rest with a Riegel meal, but none with the six-hour opaque. Apart from these 41 cases in which the *x*-rays failed to discover hypomotility, there were 22 others that gave but a minimum six-hour roentgen-ray test, in which the tube showed a large rest, in one case as much as 800 c.c. and in a number of others over 150 c.c. He concludes that the seven-hour tube test is superior to the *x*-rays for in 28 per cent. of the cases it gave evidence of a rest not discovered by the roentgen-ray method, and in 17 per cent. more it showed a marked hypermotility when the roentgen-ray method indicated but a slight disturbance.

Levy makes a criticism of the *x*-ray method that is the crux of the situation, namely that the opaque meal consists of substances foreign to the human economy and it would seem more rational to give the patient a meal he is in the habit of eating. Levy does not belittle the roentgen-ray diagnosis of gastro-intestinal conditions, but contends that the seven-hour tube test is preferable to the six-hour ray test, as the latter is not sufficiently delicate for many clinical purposes.

Treatment of Dilatation of the Stomach. Of the numerous things mentioned by Hayem²⁹ I shall give but a few. Some of these suggestions are novel and some well known. He calls attention to the pernicious habit of gastric lavage, remarking that many patients have abused the practice to such an extent as to become siphonomaniacs. He tries to avoid the necessity for lavage by reducing the number of meals and by making the interval between meals greater. Also he recommends in place of the rest *post cibum*, a repose *ante cibum*, which he states favors

²⁹ Bull. de l'Acad. de méd., 1919, lxxxi, 178.

relaxation of whatever spasm of the pylorus may be present. Despite the urgent hunger which seems to possess the individuals with gastric dilatation, notwithstanding the fact that their stomachs are full, Hayem persists with his cure and this unnatural craving for food eventually disappears. Together with the disappearance of this distressing feature, food is better assimilated, the dilatation diminishes and often disappears entirely, and the patient gains weight and strength.

Aërophagia. Piedrahita³⁰ says that the repeated movements of swallowing, the belching of gases, followed by transient relief, and the gurgling sound heard on auscultation of the cardia, aid in revealing aërophagia as the cause of certain disturbances in the stomach, heart and air passages. If the eructation is done facing the flame of a candle, the flame does not wave as it does when fermentation gases are expelled. Three unusually inveterate cases are described, in men from fifty to sixty-four years old, whose incessant but unsuspected aërophagia had caused dilatation of the stomach with consequent displacement of other organs, with symptoms that had annoyed them for twenty years. The men were enlightened as to their unconscious swallowing of air as they swallowed their saliva, and were instructed how to avoid it. The most effectual means for this is to place a cork between the teeth for fifteen minutes at a time, especially after meals. With a cork between the teeth it is impossible to swallow and the men soon conquered their aërophagic habit and with it subsided all symptoms. Piedrahita says that this habit of swallowing air is often an actual tic, and it seems to be responsible for 10 to 15 per cent. of the cases of digestive disturbances encountered at Bogota. This dilatation of the stomach stretches its walls and smoothes out the folds which shelter the secreting glands, and, besides this, the pressure on surrounding organs may induce dyspnea, intracranial oppression and sensory phenomena, unconsciousness and dizziness. He advises carrying a cork in the pocket and putting it between the teeth when the impulse comes to swallow. If there is a tendency to hyperacidity he supplements this with alkalies and sedatives to soothe the irritated glands in the stomach. By these means excessive production of saliva is prevented, which aids further in checking the swallowing of air.

"Les Petits Signes de l'Aërophagia" is the title of a short article by Leven.³¹ One of these "little signs" is a brilliantly red moist tongue, showing by its appearance continual irritation by saliva. It resembles the tongue of a diabetic, but has not the dryness of the latter. The lips are red, moist and striking and on questioning, an aërophagic sialorrhea will be complained of, shown either by the statement that he is always salivated or by the admission that his pillow is wet in the morning. Leven calls attention to special sensitiveness of the neck to tight collars, also to the importance of right lateral decubitus when sleeping. "The patient who has a brilliantly red moist tongue, marked salivation, who dribbles saliva on the pillow and can only sleep on the right side,

³⁰ Abstract, Journal of the American Medical Association, 1918, lxxi, 936.

³¹ Presse médicale, April 7, 1919, p. 184.

who cannot tolerate tight collars, complains frequently of gaseous eructations."

Many patients claim they have no eructations but their attitude in replying to questions often belies this statement, for more or less frequently as they prepare to answer, they extend the chin forward and downward toward the chest and prepare to swallow, and it is thus they swallow air unconsciously. This particular attitude with attempt at swallowing air according to Leven is pathognomonic of aërophagia.

Achylia Gastrica. Ramond³² uses the terms "anachlorhydrie" and "apepsie." Anachlorhydria means the absence of free and combined hydrochloric acid (Hayem) or the absence of active hydrochloric acid (Töpfer), but the gastric juice does not become neutral. It is more or less acid due to the presence of organic acids derived from the test-meal, from fermentation accompanying gastric activity, and probably due to a hydrochloric acid function which is not revealed by our usual reagents. Apepsia is not only the disappearance of all hydrochloric acid but of any acidity whatever. Thus considered, it is, according to Hayem, relatively frequent (5 per cent. of dyspepsias). Ramond considers this figure too high as rarely is the juice neutral, there being present almost always some acidity. According to other authors, apepsia means a juice with no digestive activity, poor or lacking entirely in hydrochloric acid and pepsin, and thus a distinction is made between apepsia and anachlorhydria—the one with no acid and no pepsin, the other with only deficient acid. Ramond recommends that the two terms be used in this sense and not as synonyms.

He has found in 340 cases of dyspepsia, anachlorhydria in 11 per cent., and apepsia in 0.5 per cent., and he explains the wide variations from Hayem's figures on the basis of a certain laxity in nomenclature, and on the variation in technic employed. Hayem and his pupils use Mett's tubes in place of gelatine tubes, the latter being much more delicate, and they have not examined for peptone, a positive proof of the existence of pepsin. The etiology of anachlorhydria may be either infectious, or nervous in origin, or may be due to intoxication. Of the infections, enteritis and diphtheria, together with influenza, are the most common of the acute infectious diseases, and tuberculosis of the chronic. The intoxications are carbon monoxid, especially war gases. It seems that palite leads to anachlorhydria and ypérite to hyperchlorhydria. Alcohol causes achylia in 15 per cent. of the cases, lead (Sailer and Speese) medicaments (Hayem) and tobacco (Hayem) are all conducive to anachlorhydria.

Nervous factors are indubitably responsible for achylia in but few cases. Melancholia, neurasthenia and tabes may be mentioned. Cancer and anemia although not included in the nervous causes, are mentioned by Ramond. He believes there is a true syndrome of anachlorhydria: The appetite is variable though more often normal; all the patients avoid eating because of fear. They learn to avoid certain foods—meat, fresh bread, dried vegetables, wine, liqueurs, and coffee. Another

³² Bull. de la Soc. méd. des hôp., 1919, xxxv, 106.

complaint is that of increase of symptoms if the patient works or is tired immediately after eating. There is an acid taste in the mouth, and after eating he has a feeling of heaviness in the epigastrium, followed by nausea and vomiting.

The x-rays show neither dilatation nor ptosis, the stomach is hypertonic and empties itself rather rapidly with the test-meal, there is less fluid than normal, and the liquid is colorless or contains rice-like particles. There is no free acidity, the total being 0.15 to 0.80 (normal two grams) if one uses the method of Töpfer. With Hayem's technic there is neither free nor combined HCl. Peptone is always present and the juice can digest gelatine tubes, even more than is normally the case. The fasting stomach always contains some liquid but this is still more deficient in total acidity.

There are still other symptoms, which are of secondary importance, post-prandial vasomotor disturbances, pains and burnings like those experienced in hyperchlorhydria, and diarrhea. As far as prognosis is concerned, it is favorable if the total acidity is equal to one gram, but unfavorable if the acidity is very low. Acid by mouth does little good, but Ramond has found that alkalies often help digestion.

Syphilis of the Stomach. "The probability of the lesion being syphilitic should be borne in mind when we find a radiograph showing very marked pyloric obstruction in a patient without cancerous cachexia," says Tousey.³³ "He may very likely be suffering from malnutrition and from gastric symptoms attributable to prolonged retention in the stomach. But there is a history of specific disease and an absence of the characteristic findings of cancer in the aspirated contents. Considering the apparently complete obstruction, the patient's appearance is remarkably good. Radiographically, the appearance is apt to be that of a simple pyloric obstruction, with sac-like dilatation and atony of the stomach. And while there are some cases of cancer which present this sac-like appearance, they are rare and usually at a terminal stage, with an unmistakable general cachexia." Tousey gives four very good plates to illustrate his article.

Azémar and Lecapère³⁴ reporting 3 cases, lay emphasis on pain, tumor and cachexia, in contradistinction to Tousey who claims there is no cachexia. The other symptoms, according to Azémar and Lecapère, are vague and often negative, no hematemesis and rarely vomiting.

Tuberculosis of the Stomach. The reader is reminded, in Friedman's report³⁵ of a case, of Broder's article³⁶ the conclusions of whom appeared in last year's *PROGRESSIVE MEDICINE*, p. 57. According to him, gastric tuberculosis may be divided into 6 types: (1) Ulcer, single or multiple; (2) miliary tubercle; (3) solitary tubercle; (4) pyloric stenosis; (5) tumor or nodule, single, or multiple; (6) lymphangitis.

The case of Friedman falls in Type 2: The patient, a woman, aged twenty years, dated her symptoms of epigastric and precordial pain,

³³ American Journal of Syphilis. 1918, ii, 472.

³⁴ Paris médicale, 1919, ix, 287.

³⁵ Journal of the American Medical Association, 1919, lxxii, 101.

³⁶ Surgery, Gynecology and Obstetrics, 1917, xxv, 490.

vomiting, headaches, loss of flesh, weakness and constipation, from swallowing a large piece of unmasticated beef four months before. A week after this she began to feel a dull pain in the pit of the stomach, relieved by taking food and recurring three hours later. The pain radiated to the left of the epigastric region, and, in addition to this distress after eating, she complained of pain on bending forward, on breathing or laughing. For the last two weeks she had pain about 2 A.M.; relieved by turning on the right side. The family history was negative for tuberculosis and carcinoma, and there was never any blood in her stools. The examination was negative, the test-meal gave 120 c.c., free hydrochloric acid 18, and total acidity 56. The x-ray diagnosis was ulcer at the lower curvature with adhesions.

On operation, an area of the lesser curvature about two inches long was found, which was thickened and inflamed and extended to the anterior and posterior surface of the stomach for an equal distance. There were numerous fresh fibrinous adhesions and large numbers of miliary tubercles thickly scattered over the inflamed area. The gross diagnosis was tuberculosis, and this was substantiated by the study of microscopic sections. Apart from the usual findings of peribronchial thickening, the chest was negative.

Tuberculosis of the stomach is a very rare condition and has been found but once in 2501 gastric operations at the Mayo clinic. Broders stated that there is no authentic case of primary gastric tuberculosis but an original focus may generally be found in the lungs or in the intestines.

Myoma of the Stomach. Nassetti³⁷ found, among 140 myomatous gastric tumors on record, 58 simple myomas and 37 fibromyomas, 6 adenomyomas and 1 myxomyoma. All the others were of a mixed sarcomatous nature except 9 listed as malignant myoma. The clinical and histologic findings in each group are reviewed, with 12 plates of illustrations. Operative treatment is the only rational measure; in 40 operative cases tabulated from the literature, the tumor was in the submucosa in 8 of the cases. One death is recorded in this group, and in 9 of the subserosa cases. Pneumonia or embolism was responsible for at least 4 of these 10 fatalities. He gives colored plates of two large pedunculated myosarcomas growing from the outside of the stomach. Four pages of bibliography are appended.

Polyposis of the Stomach. The first case of this rare disease in the Mayo clinic occurring in 69,000 abdominal sections, is reported by Balfour³⁸. The clue to the pre-operative diagnosis was given by the x-ray examination, which showed a mottled appearance of the stomach. A differentiation must be made between single polyps or papillomatous masses (the latter usually malignant) found in the stomach, to which the erroneous term gastric polyposis has been applied. Balfour calls attention to the accurate diagnosis by Carman in this case and in the only other similar case described in this country.

³⁷ Abstract, Journal of the American Medical Association, 1919, lxxii, 834.

³⁸ Surgery, Gynecology and Obstetrics, May, 1919, p. 465.

Intussusception of the Stomach. Moller³⁹ gives an illustrated description of the findings at necropsy of a woman aged sixty-six years with acute stenosis of the pylorus from intussusception of the stomach into

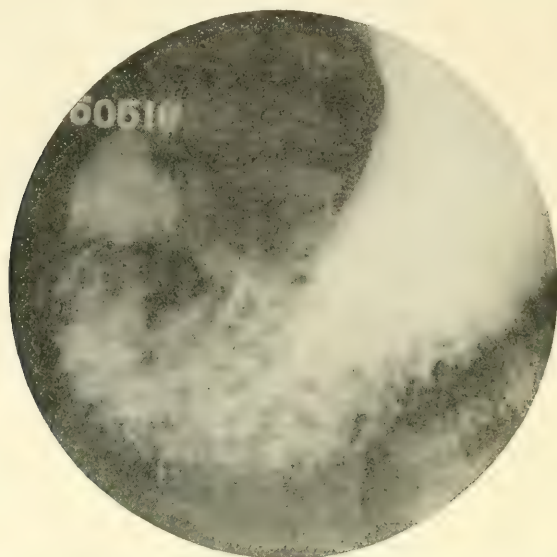


FIG. 9 (250518).—The mottled appearance (dark areas) in the roentgenogram are shadows due to the polypi in the stomach. See specimen Figs. 10 and 11.

the pyloric region and incarceration in the duodenum of a large pedunculated papilloma in the stomach. The neoplasm had probably existed for many years, but had caused no symptoms until not long before death. He has been able to find only two analogous cases in the litera-



FIG. 10.—Photograph of Specimen.

ture. All the patients were elderly women with a pedunculated tumor which had not caused symptoms until it slipped into the duodenum.

³⁹ Abstract, Journal of the American Medical Association, 1919, lxxii, 767.

Signs of stenosis of the pylorus are the first to attract attention, either chronic or acute as in Moller's case. Blood in the stools and jaundice may be observed, but the prognosis depends on the promptness of operative relief. In conclusion, he refers to Ederlen's case in which the invagination occurred in the much dilated esophagus.

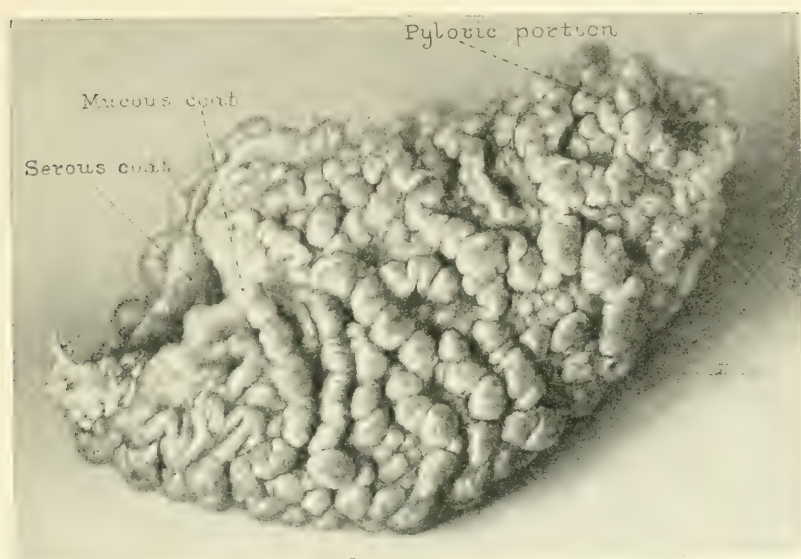


FIG. 11.—Drawing of polyposis of the stomach. Stomach turned inside out.

False Gastropathies of Intestinal Origin.—The patient comes to the physician as a gastric case; it is the stomach that hurts him and it is for stomach trouble that he seeks relief. The appetite is capricious, there is heaviness after meals, a feeling of fulness with oppression and some embarrassed breathing, tachycardia, and even post-prandial narcolepsy. He has the sensation that digestion is proceeding under difficulty, that it is persisting for a long time and that his stomach scarcely feels empty before it is time to eat again. This picture has received the name "dyspepsie sensitive-motrice" by Mathieu. These features recur after each of the two principal meals, and occasionally there are painful gastric crises consisting of epigastric cramp, accompanied by nausea and vomiting. At times there is a sensation of cramp at the cardiac end of the stomach, lasting several hours, which is associated with profuse salivation. This sialorrhea may be purely nervous in origin, but, whatever its cause, it is responsible for *aërophagia*. (See article by Leven under *aërophagia*, where he describes salivations as a symptom of *aërophagia*.) Apart from these gastric and esophagic symptoms there are certain nervous manifestations which are discussed by Faroy.⁴⁰ First there is nocturnal insomnia and a tendency to post-

⁴⁰ Presse méd., May 30, 1918, p. 271.

prandial somnolence. Sometimes there are no other symptoms associated with the insomnia but at other times there is restlessness, and a sensation of heat with perspiration; tachycardia and dyspnea, and even pseudo-angina. During the day there is headache, over-fatigue, intellectual impotence, back pains, rheumatic in character, and often transient point pains.

With this history in hand, attention is naturally centered on the stomach, but on examination there is rarely anything to be found. In some cases the x-rays show some gastric atony without dilatation or ptosis. There is one frequent sign which must be remembered and that is pain on pressure in the epigastric region. If now the physician examines the abdomen, he will find frequently spasm of the colon expressed by a cord-like feel to the descending colon or sigmoid, associated with a spasm of the transverse colon. In other cases the ascending colon will be found to be in a state of spasm and at the time when the most pain is complained of there is a hard mass in the abdomen corresponding to the lay of the transverse colon. The attention being directed to the possibility of an intestinal condition, the physician will learn that there has been more or less difficulty with the bowels despite the usual daily movement. There are periods of alternating diarrhea and constipation, with mucous stools, in other words the picture of a mucomembranous colitis or perhaps the picture of a mucous enterocolitis.

The pathology of these false gastric symptoms is probably nervous-sympathetic syndrome, or, in terms of Loeper whose work we shall later review, *enteroneuritis* or *enteroceliogastric neurosis*. As far as treatment is concerned, laxatives or purges with belladonna, associated with hyoscyamus perhaps, and hot applications, give relief.

DISEASES OF THE PERITONEUM.

Diaphragmatic Movements in Acute Abdominal Inflammation. Sale⁴¹ directs attention to the unilateral inhibition (right) of the diaphragm in cases of acute appendicitis, particularly, although it seems that limitation of the movements of the diaphragm is confined to the side on which the lesion occurs. It occurs not only in those cases in which there is an involvement of the peritoneal surface of the diaphragm but also in those cases in which the lesion is remote. Although the reason for this inhibition is not clear, it is nevertheless apparent that the study of the diaphragmatic movement with the stethoscope, and with the screen may be diagnostically useful. The auscultatory findings are, in the main, absence of breath sounds.

Abdominal Pain in Lead Poisoning. This is not the way Apfelbach⁴² words the title of his paper, but the reviewer has transposed it so as to offer an excuse for incorporating in this monograph a paper which apparently has no place in this summary. However, the subject of lead poisoning is one of much interest to those devoted to gastro-

⁴¹ Journal of the American Medical Association, 1918, lxxi, 505.

⁴² American Journal of the Medical Sciences, 1918, clvi, 781.

enterology, for mistaken diagnoses will often result unless the possibility of this cause for the symptom is borne in mind. Apfelbach has found that the lead symptom-complex differs markedly from the symptomatology given in the text-books, and is variable, this variability depending on: (1) Dosage and rapidity of dosage. (2) The presence of alloys in the metals ingested. (3) Whether the intoxication occurs in the form of fumes or in the inhalation and swallowing of lead dusts. (4) The individual susceptibility, sex, age, and personal habits.

The symptom-complex is often devoid of many of the cardinal signs. This has been described as the "monosymptomatic occurrence of plumbism" (Naegli). In many forms there are no basophilic granules, no blue line, no wrist drop and even no anemia. The consensus of medical opinion points toward blue line, basophilic degeneration of the red cells, tremor, pallor and anemia, constipation and colic as cardinals, with which Apfelbach agrees, although he prefers the expression "colic and abdominal pain from lead" to the term "lead colic." The occurrence of the cardinals in the author's series of 72 cases was:

Constipation	81.9 per cent.
Tremor	72.2 "
Pallor and anemia	65.2 "
Abdominal pain	56.9 "
Basophilic degeneration	51.3 "
Blue line	26.0 "

Constipation occurs early and is the most frequent symptom, and in severe cases may be so marked as to resemble an obstruction.

Abdominal Pain and Colic from Lead. Apfelbach has found that more lead workers suffer from gastric disturbances and abdominal pain than they do from colic. Indeed these gastric disturbances of varying kinds may precede for weeks the colic. True colic was found in 31.9 per cent. of the cases and abdominal pain in 25 per cent. These digestive upsets with their symptoms are easily confused with chronic appendicitis, duodenal ulcer, gall-bladder disease, and other abdominal conditions, all of which may, for the most part, be differentiated by the x-rays. The colic occurs as a severe abdominal paroxysm, the pain, cutting and sharp in character, crossing the abdomen from side to side, about three fingers breadth above the umbilicus. In many cases the colic may be not only about the umbilicus but also in the region of the bladder or appendix, and may resemble closely appendicitis.

The colic is relieved by pressure or by flexing the thighs, and seems to be all out of proportion to the actual tenderness. Naegli, Apfelbach says, differentiates malingerer from lead colic by this fact. During the attack there is diminished urine, slow pulse, pallor, cold clammy sweat and, in about one-half the cases, vomiting. The conditions with which colic may be confounded are particularly, acute gastritis, a diseased gall-bladder, the gastric crises of tabes, angina sclerotica abdominalis, and an intestinal obstruction.

Tremor. It is very fine, resembling that seen in hyperthyroidism. It is more rapid than that seen in neurasthenia, nicotine and drug con-

ditions, yet may be confused with these. It is a sign which cannot be simulated and hence is very valuable.

Pallor and Anemia. Anemia is an early sign and is usually associated with pallor, the latter being, however, out of proportion to the hemoglobin.

Blue Line. This occurs only when there are teeth and when they are ill-kept. Its absence does not entitle one to abandon the diagnosis of lead.

Basophilic Degeneration. Not every case has basophilia and in some normal persons and in certain diseases these granulations are seen, but never in as large numbers as in plumbism.

The important feature of this article, from the standpoint of the present review, lies in the conclusion that "as more lead workers suffer from vague abdominal pains and gastric disturbances than from colic, the differential diagnosis of any abdominal pain or colic or digestive disturbance demands the consideration of lead as the possible cause."

Tuberculous Peritonitis. Believing that tuberculous peritonitis is never a primary disease but is always secondary to some local focus of infection, W. J. Mayo⁴³ has used the title "Secondary Tuberculous Peritonitis" advisedly. The most common local foci are, in women, the Fallopian tubes, in both sexes some part of the intestinal tract, and, in children, the lymphatic system. He urges the abandonment of the belief that peritonitis of tuberculous origin is primary since if physicians recognize the secondary nature of the process, the local focus may be attacked and treatment may be instituted which will lead to cure. As early as 1904, Mayo called attention to the high percentage of cures in cases where the local focus could be found and removed, rather than by performing a simple laparotomy which after all does much good, as all will testify. At this time his interest was concentrated on the Fallopian tube and its relation to peritonitis, and he emphasized the prompt cure after salpingectomy, when repeated laparotomies had been unsuccessful. It will be supposed *a priori* that gonorrheal infection of the tubes should lead frequently to peritonitis, but it will be recalled that Murphy, in 1903, had already demonstrated the closed fimbriated end in this condition as contrasted with the open tube in tuberculosis. Thus, in the gonorrheal variety, pus tubes are known to be very common; whereas, in the tuberculous variety, tubal retention is much less common and material passes readily into the abdominal cavity, causing peritonitis. This form of peritonitis is held to be conservative with a tendency toward destruction of the noxious agents, and, should the source of these agents be removed, the peritoneum returns to normal. The reason why simple laparotomy does good is because the fimbriated ends, which had been mechanically held open by the fluid, become adherent when the fluid is removed, and further leakage is prevented. Following closure, however, retention takes place, and tubal distention results as in gonorrheal salpingitis.

Should foci other than the tubes underlie the peritonitis, great diffi-

⁴³ Journal of the American Medical Association, 1918, lxxi, 6.

culty will be experienced. The appendix itself is rarely the causative agent, but tuberculosis of the ileocecal coil and the appendix is not infrequently encountered. Similarly, the small intestine may be the seat of the evil and the gall-bladder not infrequently. The observation that bovine tuberculosis causes peritoneal tuberculosis in over 50 per cent. of the cases may be the reason for the many cures after simple laparotomy.

Laparotomy should be performed only in the ascitic form of the disease, and is contra-indicated when adhesions fill the whole abdomen without collection of fluid, or if the collections consist of multiple small pockets filled with turbid tuberculous exudate containing pus. Adhesions, by the way, are rarely due to tuberculosis alone, and, when present, a mixed infection is always to be sought. Not that viable pyogenic organisms are ever found for they are less resistant than is the tubercle bacillus, and disappear rather early, leaving only the tubercle bacillus to be demonstrated at the time of operation. The apparent "cure" of cases by laparotomy is only apparent, as rarely do the cases show improvement after three years.

The main lesson pointed out by Mayo is that one should not rely on simple laparotomy but should look for the cause or focus of the trouble. He divides the surgical cases into two groups: The most favorable are those in which a definite anatomic portion or viscus of the peritoneal cavity is involved, as, for instance, the Fallopian tubes, the ileocecal coil, and the appendix, the removal of which is easy. The second group, which is less favorable, comprises those cases in which the peritoneal cavity contains a considerable quantity of fluid occupying either the entire peritoneal cavity or a large part of it, or in which the fluid is contained in loculi composed of peritoneal adhesions, dividing the peritoneal cavity into compartments containing fluid.

Achard and Leblanc⁴⁴ call attention to that form of tuberculous peritonitis having its maximum at the umbilicus, and by reason of the tumor-like formation leading to the diagnosis of cystic or sarcomatous mesenteritis. They report a case which began insidiously as a purely abdominal condition, with vomiting and colicky pain, tympanites, ascites, mild fever and emaciation. When the ascites disappeared, as it eventually did, a tumor presented itself, and since then the patient has been in good health. No operation was performed, so that the nature of the tumor mass and its exact anatomical position are a matter of mere conjecture.

Autoserotherapy in Ascites. Maya⁴⁵ has only 2 cases to report, but the influence from the autoserotherapy was prompt and pronounced. The effect seems to be mainly on the diuresis. In both the women, the accumulations of fluid seem to be passed off in this way. He says the procedure is harmless and is certainly worth a trial in cases of ascites with still sound kidneys. The ascitic fluid obtained by puncture is re-injected into the cellular tissue, without withdrawing the needle. He injected from 2 to 6 c.c. in this way at three- or four-day

⁴⁴ Bull. Soc. méd. des hôp., 1918, xxxiv, 301.

⁴⁵ Abstract, Journal of the American Medical Association, 1918, lxxi, 1446.

intervals, a total of six and thirteen injections in his 2 cases. The ascites was of six months' and nine years' standing. There has been no return of the ascites during the seven and nine months to date.

Of course, nothing can be expected with this method when the kidneys are diseased, as Maya says, but even when the kidneys are sound, I personally have found little improvement in ascites by the use of auto-serotherapy. Maya does not state what was the cause of the ascites.

DISEASES OF THE INTESTINE.

Function of the Duodenum. Dragstedt, McClintock and Chase⁴⁶ have studied the effect on dogs of extirpation of the duodenum. They found that animals can survive indefinitely a complete extirpation of the combined jejunum and ileum, and a dog was kept alive for three months after a complete removal of the pyloric part of the stomach, the entire duodenum and the upper jejunum. They found that the normal secretions of the duodenum and jejunum were not toxic and that the normal secretions of the duodenum does not excrete into the duodenal juice any substance necessary for life or for the function of the intestine lower down.

Acute Paralytic Occlusion of the Duodenum. Hyer⁴⁷ applies this term to what others call acute arteriomesenteric occlusion, duodenojejunal ileus or acute gastroduodenal atony. The acute dilatation of the stomach is usually the most striking feature of the cases, and lavage of the stomach, with change to the prone position often brings relief and cure. In an otherwise typical case described there was no dilatation of the stomach, and von Haberer has published a similar case. The acute dilatation of the stomach may occur from some mechanical hindrance or from paralysis of the stomach or both. The mechanical hindrance may be spasm of the pylorus from an impacted piece of meat or a polyp, or a kinking of the pylorus or upper duodenum or from pressure from a tampon, as after a gall-stone operation. When the mechanical hindrance is lower down, in the lower duodenum or upper jejunum, the course is less acute; the vomit contains bile, but no fecal matter, the peristalsis of the stomach is lively but the stomach may not become dilated, and in these cases no benefit is derived from change to the prone position. Gastropptosis seems to afford a predisposition.

Hyer's experimental research on dogs has confirmed his clinical deductions that the explanation of the whole trouble is that the bowel becomes obstructed by paralysis and dilatation of the lower duodenum, irrespective of whether or not there is a dilatation of the stomach. The occlusion is induced by some kinking or some fold or valve formation at the point where the loose duodenum joins the more solidly fastened and relatively narrow jejunum, that is, at the duodenojejunal flexure. Possibly also cases occur in which without any actual mechanical occlusion, the lower third of the duodenum may become too weak to force its contents through the lumen of the flexure. Lavage of the stomach,

⁴⁶ American Journal of Physiology, 1918, xlv, 584.

⁴⁷ Abstract, Journal of the American Medical Association, 1918, lxxi, 1354.

the pelvis raised, and change of position are called for at once; the prone position or the knee-elbow, or merely lying on the right side may bring relief. If not, operative measures are indispensable. No food should be allowed by the mouth; fluids should be given by the rectum. When it is necessary to operate, jejunostomy with a drain introduced into the duodenum seems rational or, possibly better yet, expose the duodenum after dividing the gastrocolic ligament between two ligatures, and try to mobilize the flexure, making a small opening into the duodenum and inserting a drain. The cases on record in which gastrojejunostomy was done or merely the duodenum evacuated have given bad results, as also gastrostomy.

Duodenal Dyspepsia. Gaultier⁴⁸ believes that cases of duodenal dyspepsia are individual and characterized by functional, physical or general signs of the following variety:

FUNCTIONAL SYMPTOMS. *Appetite.* When the features of pancreatic dyspepsia (diminution of ferments) predominate there is polyphagia and when the dyspepsia is principally biliary (diminution in the amount of bile), there is a decrease of appetite.

Pain. Pain is not in the region where gastric dyspeptics complain of discomfort, but is in the periumbilical and subumbilical regions. At times it predominates in the right hypochondrium and at other times in the left hypochondrium. Radiation to the right shoulder or to the loins is not infrequent, a feeling of a heavy weight in the abdomen two or three hours after eating is not uncommon, also not infrequently there are violent colics accompanied by abdominal distention, ending in a veritable débâcle of gas.

Nausea is rather common but actual vomiting is rare, rather there is a sort of regurgitation several hours after eating, a regurgitation of tenacious viscous material, containing no food.

Alternate constipation and diarrhea are seen.

Among the physical signs, abdominal distention is the most conspicuous, coming on two or three hours after a meal, accompanied by respiratory and cardiac embarrassment and ending with an excessive discharge of gas. Palpation of the peri-umbilical region gives pain in the duodenal zone.

GENERAL SYMPTOMS. Yellow skin, malaise, general fatigue, torpor, somnolence, muscular atrophy, flabbiness of the tissues are among the general symptoms. There may be glycosuria, decrease in urea, and the total sulphate-etheral sulphate ratio may be raised.

The reviewer finds in Gaultier's syndrome a striking similarity to the picture painted by Lane in stasis.

Experimental Study of Duodenal Ulcer. In a previous contribution Jona⁴⁹ demonstrated that the subcutaneous injection of extracts of decomposing animal tissues gave rise to a condition comparable with gastroduodenal ulceration. It was also shown that these extracts exerted an inhibiting action on the secretion of saliva and pancreatic juice. It was contended that one factor, at any rate, in the causation

⁴⁸ Bull. Soc. méd. des hôp., 1918, xxxiv, 709.

⁴⁹ Medical Journal of Australia, 1919, i, 316.

of gastroduodenal ulceration was an inhibition of the normal flow of pancreatic juice. Based on this, Jona ligated the pancreatic ducts in dogs and was able to produce duodenal ulceration corresponding in location to the common sites of duodenal and jejunal ulcer.

Clinically, he studied the effects of the administration of secretin, given a half hour before meal time, so that it would enter the empty stomach and not encounter hydrochloric acid (Rehfuß would not agree with the supposition on Jona's part that the stomach was ever empty) but would be immediately passed on into the duodenum to be absorbed. He has used secretin (Fairchild), B. W. & Co., or liq. extr. duodeni acidum (Fairchild), B. W. & Co.

In all patients immediate benefit was derived, and they have progressively improved. He has, in addition to the use of secretin, taken care that coprostasis and constipation have been corrected, carious teeth removed, septic tonsils attended to and other sources of toxin absorption cleaned up.

Thread Test for Bleeding Ulcer. Van Leersum⁵⁰ reports a case in which Einhorn's thread impregnation test permitted the exact localization of a peptic ulcer. Gastro-enterostomy had been done a year and a half before, but the pylorus had not been shut off. The vomiting and the pains, increased by eating and by exercise, and the occult blood in the stools testified to ulceration, although the marked tendency to hysteria had convinced the attending physician that the whole trouble was a gastric neurosis. The Einhorn thread showed a brownish discoloration for a stretch of 2 cm. low on the thread. Immediately below there was an abrupt change in tint to green, showing the action of bile. The assumption therefore was that the new ulcer was in the region of the gastro-enterostomy opening, which roentgenoscopy showed was no longer permeable. This proved to be the case, and, after excision of the fistula region with its ulcer, and closure of the pylorus, clinical recovery followed. In a second case this discoloration of the thread between 45 and 50 cm. from the lips, and the abrupt change to green below located the ulcer in the margin of the gastro-enterostomy opening. This patient had already had two operations for gastric ulcer, and refused to permit a third. The thread can be swallowed more readily if a scrap of cracker or meat is tied in the end. There is no need to use the duodenal bucket when the question is merely to locate the bleeding point. The length of the chest, etc., must be taken into account in estimating the location of the tumor from the thread. Einhorn's figures do not give a wide enough range. Van Leersum warns, in conclusion, that the ease and simplicity of this test commend it to such a degree that there is danger that physicians will use it exclusively and rely too implicitly on its findings. "*L'Histoire se répète*," he says, "and especially in medicine, and this notwithstanding our dearly bought experience teaching us that we should never rely exclusively on any one test, any more than on the anamnesis alone."

Treatment of Duodenal Ulcer. After discussing the diagnosis of duodenal ulcer in a purely academic way, Satterlee⁵¹ proceeds to give his

⁵⁰ Abstract, Journal of the American Medical Association, 1918, lxxi, 2032.

⁵¹ Medical Record, 1918, xciv, 265.

views regarding its treatment. This should be considered under two heads: (a) Palliative, (b) Curative. He draws attention to the fact that the treatment is not wholly a medical problem nor entirely one of surgery, but that medicine and surgery must share equal responsibility. The essentials of medical treatment are: (a) diet, (b) rest, (c) drugs, (d) duodenal lavage and local measures. The first ten days should have a rigid diet of milk, eggs, and egg albumen with frequent feedings, following which the diet should be gradually increased. In general, the easily digested and non-irritating articles of food are: Milk, sweet or fermented, egg albumen, rennet, cooked fruit of the non-acid type, stale bread or toast, butter, cream, thoroughly cooked vegetables, especially the green ones, and the light cereals, particularly strained oatmeal gruel. The foods usually contra-indicated are: All kinds of meat and fish, acid fruit and raw fruit, vinegar, spices, large amounts of sugar, the heavy starch vegetables, as potatoes, lima or baked beans. Articles containing large amounts of cellulose and bran are not contra-indicated and are useful for a coexisting constipation.

Drugs. Alkalies are always useful and in many cases absolutely necessary. Bicarbonate of soda is the best, and magnesia next. Bismuth subnitrate combined with heavy magnesium carbonate will give temporary relief in nearly every case. Bicarbonate of soda in hot water or milk is valuable. Alkalies are best administered two to four hours after a meal, and are to be regarded as purely palliative. For the attacks of pain, tincture of opium and the camphorated tincture are the best preparations of opium. Morphine hypodermically may be used when there is great gastric irritability, but is not so satisfactory as opium internally. Orthoform is better for gastric ulcers than for duodenal ulcers. Satterlee has used benzyl benzoate for the relief of pylorospasm, and has found that it gives complete relief in half an hour to one hour, followed by a refreshing sleep. Adrenalin has been highly recommended because of its action on smooth muscle. Local application of heat or cold to the abdomen has been found to afford much benefit.

The duodenal tube, when used, should be left in overnight and benzyl benzoate given if there is pylorospasm. The following morning on an empty stomach the duodenum is washed out with plain hot water or soda solution, followed by 100 c.c. of silver nitrate, 1 to 20,000 up to 1 to 1000, or 20 per cent. argyrol. Only when medical treatment is unavailing should surgical treatment be recommended.

Intestinal Stasis. INDICATIONS FOR OPERATIVE INTERFERENCE. Lane⁵² recognizes that not all the cases are operable, and that "the administration of paraffin before meals, the use of a Curtis belt, the assumption of the recumbent posture at intervals, careful dieting, and the employment of such drugs as relieve the symptoms of hyperacidity, etc., will usually afford the patient complete relief." The group of cases in which distention is clearly(!) due to damming back of the ileal contents by the pressure exerted by a "controlling appendix" or by an

⁵² *Lancet*, March 1, 1919, p. 333.

"ileal kink" demand treatment other than medical. The degree of damming can be determined from the appearance of the patient, history of the case, from the pain elicited on pressure on the inflamed and hypertrophied end of the ileum, and from the *x*-ray findings. Of most importance are the *x*-ray examinations where the examiner is particularly experienced in screen work.

Conditions Calling for Gastro-enterostomy. In the presence of peptic ulcer in stomach or duodenum, or both, gastro-enterostomy should be performed and the gastric ulcer should be excised. When the stomach and duodenum are dilated and the latter obstructed by kinking to such an extent that no freeing of the stasis in the lower bowel is likely to overcome this angulation, gastro-enterostomy should be performed. It is not sufficient, in the presence of peptic ulceration, to limit the surgical treatment to gastro-enterostomy as Lane insists this does not influence the preëxisting "*auto-intoxication*" (the italics are mine!). One must examine closely the terminal ileum through a large incision for the "last kink."

Colectomy. "In such conditions as extreme constipation, in which an evacuation can be obtained only at intervals, and with great difficulty and pain; rapid and progressive wasting; mental depression which may be so great at times as to make life intolerable both to the individual and the relations, not infrequently driving the patient to attempt suicide as the only escape from insufferable misery; total inability to lead an active life; a distressing absence of sexual desire leading to constant broils; progressive degenerative changes in the breasts of those with marked family history of cancer, toxic changes in the heart and circulation, and all secondary conditions such as rheumatoid arthritis, Raynaud's disease, Still's disease, many forms of tubercle, Bright's disease, Addison's disease, in these and many other conditions colectomy offers the only hope of cure." Were not Lane so original in his writings, one might almost suppose he had been influenced somewhat by Rabelais.

And he defines colectomy in no uncertain terms as the complete removal of the large bowel with the exception of a sufficient length of the pelvic colon to establish continuity. Following such an operation, unless postoperative adhesions result, "the patient's health improves at once in a marvellous manner. Perhaps no alteration is more marked than the change in the mental state of the patient, showing how dependent the functioning of the brain is upon that of the intestine. The most miserable and wretched woman becomes happy, gay, and lively. The other symptoms clear up with remarkable rapidity." The vast majority of colectomies are performed, he says, for *auto-intoxication* (the italics are again mine!) and its results, and not for the mechanical effects of stasis.

An article by Panchet⁵³ seemed at first reading to be of material suitable for abstracting but a second perusal was less profitable and seems to justify the opinion that it is merely a résumé of the English views with nothing new or novel from the Gallic perspective.

⁵³ La Presse médicale, March 24, 1919, p. 151.

MEDICAL TREATMENT. Treatment of this condition by duodenal lavage is, according to Aaron,⁵⁴ to be recommended because, by clearing out the whole of the intestine above the obstruction, the bowel is given an opportunity to recover sufficient tonicity to overcome the stasis. Certain indefiniteness as to how the cure works obscures his reasoning, for we note, "If there happen to be adhesions, compensation takes place in some way or other, and recovery is the result. The kink may remain the same, but the patient recovers his health which, after all, is the practical object of any treatment in any condition." "If" the patient recovers his health! But we are told all these cases of Aaron's are recent cases and that he cannot speak of end-results until after a lapse of years. But to describe the method. The duodenal tube of Jutte is recommended, and through this is poured a liter of water containing 60 grams of sodium sulphate. The lavage is given daily for ten days, as a first series of applications; then, on alternate days, for another ten days; and the third series follows at intervals of three days, the number of treatments given in this last series being only three or four. To make sure of success, a lavage once a week is given until recovery is fully established.

We wish that Aaron had made this article a little less casual and a trifle more exact, and had given us the grounds upon which he has builded his diagnoses. Based presumably on the therapeutic success, he concludes that kinks and bands are not necessarily the cause of stasis, and that consequently their surgical removal will not cure the stasis. All well and good, for not all of us believe in kinks, anatomic or therapeutic, but the author proceeds to a less logical conclusion in that "any other pathologic condition—rheumatoid arthritis, gout, functional disorders of the heart, arteriosclerosis, epilepsy, asthma, cirrhosis of the liver, primary and secondary anemia, skin diseases, catarrhal inflammation of the mucous membranes, eye disease, neuralgia, neuritis, insomnia, neurasthenia, melancholia, dementia and insanity—should disappear after successful duodenal lavage treatment, if these conditions are really caused by intestinal stasis, and if they do not disappear after the supposed causative factor has been removed, it follows that the etiology requires correction—that these conditions were not, after all, due to intestinal stasis."

It is scarcely the object of this yearly review of medical work to discuss logic, but I cannot forbear to question the justification for such statements. To say that if a disease is not cured after the causative factor is removed is an exaggeration of clinical experience which no one should make. I am not an adherent of Lane's teachings, but, if I were, I should welcome Aaron's "therapeutic test" statement with open arms, if I could believe it, for Lane contends he cures diverse and strange ailments by removal of the "last kink," and, according to Aaron, this proves the etiology, although if duodenal lavage does cure cases similar to Lane's patients, then kinks are not the cause! I have disliked the writing of the chapter on Stasis for some years, and it is mainly because

⁵⁴ Medical Record, August 17, 1918, p. 268.

of the "torrent of literature which has been poured out in recent years on this seemingly interminable subject of intestinal stasis" to quote Aaron, and which has to be read. The outstanding work of the year in gastric enterologic matter to my mind is the paper on Auto-intoxication, by Alvarez, a reprint of which should be in the hands of all the myriads who think they must write on intestinal stasis.

Hayem⁵⁵ has recommended saline solutions for many years and in this paper he asserts he has obtained good results by the use of an artificial Chatelguyon water made as follows:

A		
Distilled water		1.0 liter
Sodium chloride,		
Magnesium chloride (crystallized)	āā	1.5
Bicarbonate of soda		2.0
B		
Distilled water		1.0 liter
Sodium chloride,		
Magnesium chloride (crystallized)	āā	2.5
Sodium sulphate		3 to 5

These two formulæ are particularly applicable in the treatment of dilatation of the stomach due to myasthenia with, or without, atrophy of the muscular coat, and with absence of mechanical constriction. The majority of patients are benefited by (A), but when constipation persists, nevertheless, (B) should be used. The magnesium chloride, he says seems to be very efficacious on the smooth muscle fibers of the digestive tract.

Constipation. Several articles from countries with whose language I am unfamiliar have appeared in abstracts in the *Journal of the American Medical Association*. This abstract feature of the Journal, by the way, has recently been made the subject of much praise by an Italian colleague,⁵⁶ and it is indeed a feature which is much appreciated by all who find it necessary to review the world's literature on a given subject. In just such times as the present, when the review is intended to be comprehensive and to include all of the most important work from all countries, the Journal's able staff of abstractors makes my work somewhat less arduous and certainly more widely extensive than would be possible without their assistance.

Martinez,⁵⁷ in discussing habitual constipation, remarks that the action of purgatives is much more complex than is generally realized. They inflame the bowel with consequent exudation, they stimulate the digestive glands to hypersecretion, and there is desquamation of the bowel mucosa, along with other phenomena which suggest that the purgative induces the formation of some substance that is carried to all points in the glands, muscles and nerves. A similar result can be attained with magnesium sulphate hypodermically, he says, reporting excellent results from its use. It modifies conditions so that the habit

⁵⁵ Bull. de l'Acad. de méd., June 11, 1918, p. 440.

⁵⁶ Journal of the American Medical Association, 1918, lxxi, 608.

⁵⁷ Abstract, Journal of the American Medical Association, 1918, lxxi, 413.

of constipation seems to be broken up. He gives the magnesium sulphate in a 25 per cent. solution, using ampoules containing 0.5 gm. of the drug in 2 gm. of distilled water, and injects one ampoule a day, continuing for from six to ten days as a rule in inveterate cases. In the mild cases one or two injections may suffice, or half the above dose may be given. As a rule, by the sixth or tenth day even the most inveterate constipation is broken up permanently. In exceptionally intractable cases, he injected two ampoules morning and night, in arm or buttocks.

Belaunde,⁵⁸ also writing in a Spanish Journal, says that results with Martinez' treatment are marvellous. When the stools become fluid, almost diarrheic, the treatment is suspended. The tendency to constipation seems to be permanently cured. No mention is made in the abstracts of Martinez and Belaunde's work of how long they had been using this treatment, but Belaunde says that in the innumerable cases thus treated, the constipation that had been rebellious for many years has not returned during the months and years since this treatment was used. If the course fails, he recommences two, three or four times the doses. But it has never failed in his experience when conscientiously applied, although some cases required 30 to 40 injections. If the series is suspended, for any reason, it has to be commenced over again from the first. No saline or other purges must be allowed during the course of treatment or afterward. He summarizes 80 case histories to show the condition before and after the successful treatment. Spontaneous defecation occurred after the fourth injection and the stools became soft at the seventh in most of the cases.

A three-day meeting of the Medical Association of Argentina was held to discuss chronic constipation from all points of view. In the *Revista de la Asociaciòn Medica Argentina* appeared a number of papers which have been reviewed, abstracted and condensed into a short abstract.⁵⁹ Udaondo emphasized the frequency of stomach derangement, especially motor insufficiency, as accompanying constipation. There seems to be a rupture of the gastro-intestinal functional correlations. Hyperacidity was exceptionally frequent in his cases of chronic constipation, as well as other symptoms indicating a neurosis of the vagus. This may disturb the functioning at almost any point in the digestive tract; spastic conditions or atony hindering the normal passage of stomach and bowel contents, and entailing acidity. In a number of cases tobacco seemed to be responsible for the irritation of the nerves, as conditions righted themselves when tobacco was dropped. The deleterious influence of tobacco was particularly manifest in cases in which spastic colitis was the principal manifestation of the hyper-vagotony.

Arana discussed the surgical treatment for pericolicitis and megacolon, and reported 8 typical cases, with illustrations. Ymaz emphasized that rational medical treatment of habitual constipation is possible only when the exact cause has been ascertained. He reviewed the

⁵⁸ Abstract, Journal of the American Medical Association, 1919, lxxii, 1710.

⁵⁹ Journal of the American Medical Association, 1918, lxxii, 690.

medical field, and warned that a diet to give more bulk to the feces must not be carried to extremes, as too large a quantity of indigestible tissues probably injures the mucosa more than a mild chemical stimulus. Morena remarked that pericolic membranes are a frequent finding at necropsies of children with a tendency to so-called chronic appendicitis. He has encountered in children all kinds of pericolitis and abnormally large cecum, colon, etc., and in nearly every instance there were attacks of pain, or a chronic pain. But very seldom did these children display any tendency to chronic constipation. These findings sustain the assumption of the frequent congenital origin of these lesions.

What appear to be two able articles by Thaysen, a Scandinavian writer, fortunately have been fully abstracted.⁶⁰ In the first paper he discusses the diagnosis, etiology and treatment of chronic habitual constipation. He defines it as primary, habitual; secondary, symptomatic; and the constipation which is a complication of other lesions. He affirms that the large majority of cases of chronic constipation developing between the ages of twenty-six (women) or thirty-one (men) and the age of fifty years are of the symptomatic type. This form differs materially from the type of habitual constipation both in the stools and in its clinical course. Habitual (primary) constipation is due to abnormal weakness or abnormal activity of the nervous motor apparatus of the lower bowel; it usually begins before the age of twenty-one years in women and thirty-one years in men. It runs a chronic course, with occasional remissions and marked tendency to recurrence, and a hereditary tendency is often manifest. The latter tendency may be indirect, from congenital overcomplete digestion. Coöperating elements may be lack of hygiene, or nervous, medicinal, and mechanical factors. He analyzes each of these possible factors in turn and the means to combat them. Ptosis is extremely rarely to be incriminated for constipation in men, but habitual constipation developing between fifteen and twenty years is as common in males as in females, namely, in 29 and 31 per cent. This, he thinks, disproves the importance of ptosis as a factor.

Fully 38 per cent. of all cases of habitual constipation in women begin within the fifteenth year. Excluding from the remaining 62 per cent., the 37 per cent. which are traceable to what he calls rectum constipation, only 25 per cent. are left for which ptosis can possibly be incriminated. Those percentages are from his own clinical experience. Of the 23 women who formed the 25 per cent. thus left over, only 4 presented gastropptosis, that is, less than 5 per cent. of the total material. Hence the assumption of kinking of the bowel from gastropptosis as the cause of chronic constipation can apply only to less than 5 per cent. All his experience seems to discredit kinking at the flexure as much of a factor in the genesis of chronic constipation. When there is actual stenosis from a kink or other cause, ileus results in time, while with habitual constipation this occurs extremely seldom, only when there is obstruction from a fecal stone or spasmodic contraction. It is impossible to

⁶⁰ Journal of the American Medical Association, 1919, lxxii, 838 and 1116.

explain with a mechanical cause for the constipation the frequent remissions which occur in the course of habitual constipation, even of many years' standing.

It is a well-known fact that the latter may disappear for a time during a trip to the country, or other travelling or under emotional stress. In concluding this instalment of his work, Thaysen remarks that in examining 20 healthy women and 20 healthy men, he found the transverse colon 10 cm. or more below the umbilicus in 20 per cent. of the men and in 50 per cent. of the women, although the position of the stomach was normal in all. He also found that this position of the colon may vary by 8 cm. from day to day.

In the second of Thaysen's papers, or the eighth of a series of papers on "Habitual Constipation," treatment is the subject. He calls his method the alaxative and is based on the principle of absolute abstinence from laxatives and training the bowels to move at a certain hour every day. This is called Dubois' principle, but Thaysen does not accept the statement that constipation is the result of psychic inhibiting processes. Dubois advises suppressing the desire for defecation at any other time than the appointed hour, but Thaysen advocates heeding it and yielding to it whenever it may occur, but always going to stool regularly, at the appointed time each day, regardless of whether there is a desire or not. The idea that it is impossible for one to have a normal passage certainly aids in maintaining the constipation, and emotional stress might check bowel functioning for a brief time, but otherwise he does not believe in a psychic etiology for habitual constipation. Some even regard the matter from the opposite point of view, maintaining that habitual constipation is the cause of psychic disturbance, neurasthenia, etc. He emphasizes that the danger of going a long time without defecation is not so great as is generally supposed. No signs of inflammation were observed even when a patient went fourteen days without stool.

He gives the patient a card with printed directions to rise, for instance, at 8 A.M.; at 8.15 A.M., drink a glass of tepid boiled water; at 8.30 A.M., a light breakfast and at 9 A.M. to go to the water-closet and strive to have a passage, devoting fifteen minutes to it, if necessary. At 9 P.M., eat some stewed fruit; retire at 10 P.M. Of course these hours can be altered to suit the patient's habits, but always have the meals regular and ensure plenty of sleep. If there is a desire for defecation during the day it is to be yielded to, as this aids in recalling to life the torpid defecation impulse. If the main defecation impulse is found to come at some other hour than in the morning, this hour can be appointed for the regular time and everything done to make this the center of the training of the bowel. With this alaxative treatment, natural movements usually begin by the third or fourth day. If the feces are very hard at first, a small oil enema or cacao butter suppository will remedy this.

When dyspepsia accompanies habitual constipation, it generally develops several years after the onset of the latter, the pain at the cardia comes on soon after or during the meal, and the position, secre-

tion and motor functioning of the stomach seems to be normal, or there is some slight secretory anomaly (mainly in men) or motor disturbance (mainly in women). The constipation, further, is of the habitual type, that is, it became a settled habit before the age of twenty-six in women, and thirty-one in men. The dyspepsia depresses the vitality and this sets up a vicious circle. Anorexia in these cases is usually of psychic origin, and the patient must have his interest aroused in his food. Psychotherapy here may prove more successful than the most skilful dietetics. If the alaxative treatment fails completely, the next best treatment is with rectal injection of warm oil, 150 c.c. to be retained overnight. The introduction of this method has wrought a revolution in the treatment of constipation, he adds, but it has the disadvantage of being more symptomatic than causal.

A curious viewpoint is that of De Castro⁶¹ who, among other things, insists that a single passage a day indicates in itself a certain amount of paresis of the bowel and some auto-intoxication, and that, normally, there should be a defecation after each digestion. He believes too, that the rising sun influences peristalsis and advocates a glass of cold water sipped as the sun is rising in order to utilize this reflex which the rising sun induces in the healthy organism. An alarm clock is recommended so that one may be awakened to take advantage of this moment of positive sidereal influence. He disapproves of paraffin and similar preparations.

IN PROGRESSIVE MEDICINE, December, 1912, p. 102, I quoted a method described by Fernet which I have used repeatedly since I read his article and from which much benefit has followed. I take the liberty of re quoting the abstract made at that time: "The patient, before rising in the morning, is to lie on the back and take five or six deep breaths, with the mouth closed, protruding and retracting his abdomen with each respiration. (I have since found it useful to have the patient protrude his abdomen five times with the chest inflated, and to retract the abdomen when the lungs are fully collapsed.) After a few moments of natural breathing, the procedure is repeated, and is kept up for five or six times. By means of the deep breath, Fernet claims that the abdominal organs are subjected to a kind of massage, which is furthermore augmented by manual massage (in the direction of the course of the colon) during the remissions of normal breathing. After rising and bathing, the patient should partake slowly of breakfast, and afterward go to the toilet, whether he feels the desire to defecate or not. If there is no bowel movement, the breathing exercises should be repeated, and, in place of the massage, rectal exercises should be practised, consisting of voluntary movements of the anus, efforts at expulsion and retention. Under no condition should there be any straining. Fernet is insistent that there should be no laxative, enema, or suppository used, for with his treatment any auxiliary measure is unnecessary." This method is worthy of trial and is really an alaxative method in Thaysen's sense. The other methods described in this review seem to

⁶¹ Abstract, Journal of the American Medical Association, 1918, lxxi, 782.

have been successful in many instances. The injection of substances for the treatment of constipation does not make a particular appeal, as there seems to be no check on their action once the solution has left the syringe. Thaysen's articles, as read in abstract, appear to be the sanest that have been published in recent times; his observations and conclusions are based on careful study, and treatment appears to be rational. That there is a psychic factor in constipation, quite independent of the habit factor, there can be no doubt, and Thaysen has done well to emphasize this point.

Labbé⁶² insists that constipation is among the most serious of war disease, although my experience with our troops for almost two years has been quite the opposite. In fact, as stated in the beginning of this article, it has always seemed to me remarkable that there should be so few diseases of the gastro-intestinal tract during the war. Labbé speaks, of course, of the French army, and ascribes the constipation to a diet too rich in meat and too poor in fresh vegetables. These normal dietaries of the French and American man vary as we are accustomed to much meat eating and few green vegetables, while our French cousin is used to just the opposite condition. Added to this the life in the trench, where it is difficult and at times even dangerous to defecate makes the French soldiery frequent sufferers from constipation.

Labbé recognizes the following forms:

1. *Simple Constipation.* It would be of no interest were it not that it is oftentimes the prelude of more serious symptoms such as dyspeptic disturbances, abdominal pain, distention after meals, vomiting, fetid breath, coated tongue, and on palpation fecal masses in the colon, principally in the left iliac fossa. All these are promptly cured by thorough evacuation and regulation of subsequent bowel movements.

2. *Spasmodic Constipation.* This is but a degree more than the above, in which the intestine irritated by the fecal stasis, reacts by a permanent spasm. In addition to the usual dyspeptic symptoms, heaviness or pain in the left iliac fossa is a prominent feature. Palpation recognizes accumulation of feces and causes pain. The stools are evacuated rarely and are usually hard and coated with mucus, at times scybalous masses or filiform in shape.

3. *Atonic Constipation.* In some cases it is impossible to speak of intestinal spasm as there is no clinical or radioscopic evidence of this condition. The fecal column passes through the large intestine, sometimes stopping in the cecum, sigmoid or in the rectum, without, however, showing a predilection for any one point. Labbé expresses it as there being especially a laziness of the colonic contractions ("Il semble qu'il y ait surtout une paresse des contractions coliques"). On palpation everything is soft, and no masses, no unevennesses are felt, except in the rare cases where there is a good deal of abdominal distention from gas. Subjective symptoms are uneasiness and fulness after eating, vague abdominal sensations, particularly in the flanks. Pain is less severe and accompanies the colitic crises which end this form of constipation.

⁶² Presse médicale, July 25, 1918, p. 385.

The form of atonic constipation which is common in peace times is rare in the army as the atonic individual, he says, is never accepted for military service.

4. *Constipation with Intoxication.* Whatever form is seen it is frequently complicated by symptoms of intoxication (see Auto-intoxication). Labbé seems to be much interested in this complication for he devotes some space to detailing two typical cases, whose symptoms disappeared almost immediately following evacuation. He mentions abdominal distention as being a prominent symptom, and, after reading Alvarez's explanation of the so-called "auto-intoxications," this symptom seems to be particularly noteworthy.

5. *Constipation with Irritation-colitis and Pericolitis.* Prolonged constipation leads to irritation of the intestinal mucosa which causes inflammation and colitis, and which, if unchecked, extends even beyond this intestinal wall and causes pericolitis. Colitis is frequent in the terminal portion of the large intestine, and is recognized by the passage of hard fecal masses covered with mucus and often blood-stained. Pain and induration of the intestinal wall is recognized on palpation of the left iliac fossa. If inflammation is still more excessive, sigmoiditis occurs and is recognized by false diarrhea—frequent defecations, serous in character, brown in color and containing mucus, despite which, however, the intestine retains scybalous masses readily made out on palpation. Later alternate constipation and diarrhea appear, fetid stools, poorly digested food particles, mucus, permanent pain in the right iliac fossa and tenderness in this region, with detection of an indurated intestine on palpation.

Pericolitis is difficult to diagnose. Pain is the most conspicuous symptom, increased by movement, pressure of clothing, palpation and peristaltic movements following ingestion of food. It may be in either the right or the left iliac fossa, radiating to the right or left hypochondrium or the rectum. Palpation of the abdomen is very painful, and deep palpation is followed frequently by prolonged and excruciating pain. As the case progresses, the painful crises increase, signs of obstruction and localized peritonitis appear, and vomiting and abdominal distention (never ascites) are seen. X-ray examination, when positive, is diagnostic, but it often happens that the radiosopic studies show nothing abnormal. The diagnostic signs, according to Labbé, are: (a) Signs of irritation, pain, digestive disturbances of no special definite character; (b) absence of intra-intestinal inflammation (well digested stools, little mucus, and no blood or soluble albumin).

Treatment should first be preventive and diet poor in meat and seasoned food, and rich in vegetables and in fruits is advised. Some suggestions for military hygiene are offered, too.

In simple constipation, he recommends olive oil, agar-agar, and advises recognition of the individual's predilection for ways and means—cigarette or pipe before breakfast, hot water, cold water, orange, raisins, and even bismuth in one man produced the desired laxative result. He recommends suppositories, and in injections of oil, water and gly-

cerin. The ordinary laxative drugs should be used with caution and for not too long a time. Saline purges constipate after a time. A cup of coffee containing equal parts of sulphate, citrate and bicarbonate of sodium has, in his hands, achieved good results. If the spasmodic element in constipation predominates, belladonna and valerian are indicated; if atony, on the other hand, strychnine, glycerophosphates, and suprarenal extract.

In toxic constipation, a vegetable regime forms the basis of treatment, and eggs, meat and milk should be avoided. Not too great strictness should be indulged in by the physician, as nourishment must be nourishing and the patient's general condition should not suffer impairment. He advises lactic acid bacilli, calomel, beta-naphthol, salol, etc., also castor oil in small doses and colonic irrigations.

Constipation with inflammation should be treated with a minimum of drugs and if any are to be used castor oil is the best borne.

Auto-intoxication. Alvarez,⁶³ probably the sanest writer on this much-discussed subject, touches a responsive chord in the hearts of those who have repeatedly inveighed against the hit or miss use of the term "auto-intoxication." He says, "I wish in this paper first to protest against the thoughtless way in which many of us are constantly making the diagnosis of 'auto-intoxication.' I do not deny that there may be such cases but my experience in looking over the people who have been classified as such by other physicians makes me feel that the real article must be rare," and again, "There are a considerable number of men, however, who do examine their patients and who still believe, after finding nephritis, hypertension, arteriosclerosis, or gastric ulcer, that these diseases are due, directly or indirectly, to intestinal stasis. Some persist in this view even when it is shown that the patient has no stasis. Such men, it seems to me, are hopeless and beyond the reach of argument." I recall only two vividly certain criticisms levelled at me because of my remarks anent auto-intoxication and it is more than a pleasure to acknowledge the support of men like Alvarez, Taylor and Adami in this matter.

It is, according to our author, not enough to show that toxic substances can be formed during the bacterial destruction of nitrogenous matter. It must be shown that these toxins are formed in the intestine; that they can pass through the mucous membrane; that they can escape destruction in the liver; that they can reach the general circulation in amounts sufficient to produce symptoms, and that the symptoms produced by the repeated injection of small doses of these substances into animals are similar to those observed in constipated men. Although enormous numbers of bacteria are found in the feces, it must be remembered that nearly all of them are dead, and he quotes Distaso to prove this contention that they can do little harm. In *PROGRESSIVE MEDICINE* of 1912, p. 95, Distaso's article was reviewed in detail, and from my remembrance of it I should feel that Alvarez has not chosen a partisan for his view, but one who is arrayed in armor in the lists of Lane.

Colonic stasis, the prime cause of intestinal toxemia, receives hammer

⁶³ Journal of the American Medical Association, 1919, lxxii, 8.

blows from Alvarez, and since his reasoning, as always, is logical, lucid and convincing, again free use will be made of his article. According to Mutch, the flora of the colon is a protective and useful mechanism insuring the breaking down of nitrogenous substances into innocuous bodies—phenol, ammonia, water, carbon dioxide, hydrogen, and indol-acetic acid, indoxyl and indol. In the colon there is even less chance for absorption of toxic substances than there is in the small bowel, and none at all, even when by short-circuiting, the colon is changed into a blind sac full of stagnating feces. From studies on nutrient enemata only water, salt and a little sugar have been shown to be utilized. Also we know that the feces begins to harden in the ascending colon, and thereafter undergo no churning movements, as they go forward through the remainder of the bowel like cars on a track. Therefore very little absorption can be expected under the circumstances, as to get absorption the feces must be liquid and churned actively to and fro as are the jejunal contents.

Alvarez goes on to say that many writers on auto-intoxication have recognized this difficulty and have struggled to evade it, Bouchard stating that with the dying out of the bacteria in the hard, dry feces, constipation ought to be regarded as a protection against auto-intoxication. Combe, the greatest protagonist of auto-intoxication, admits that colonic stasis probably can have little effect on health, and that the stagnation and absorption must be looked for elsewhere in the tract, but Alvarez replies to this that in constipation the colon is practically the only place where stagnation does take place. When there is stagnation in the small intestine, it is of such short duration that very little bacterial action takes place. Duodenal stasis is rarely seen and is generally an artefact, and, furthermore, has little to do with auto-intoxication. After attacking in no uncertain manner the work of Bouchard, Combe, Metchnikoff and Lane, he makes the statement, which pleases me, since I have long made the same contention, that "although there are many clinical facts which strongly suggest that poisons are absorbed from the digestive tract during constipation, we have as yet very little actual proof for this assumption." Furthermore, I believe there is no one clinical picture in auto-intoxication, if there be such a disease, and certainly, to date, no means at hand justifying one in making this diagnosis. The fact that many individuals claim to be instantly relieved of their symptoms by a bowel movement proves nothing, as it is inconceivable that a systemic condition could be relieved in a few moments by an evacuation.

Alvarez believes that these symptoms are due not to toxic but to mechanical distention and irritation of the lower bowel by the fecal masses. Classical symptoms of "auto-intoxication" can be produced by inserting a cotton tampon in the rectum, also with masses of barium and cacao butter suppositories. Even pressure of the finger in the rectum produces typical symptoms. Sensory impulses from our digestive tract profoundly influence our vasomotor balance, our emotions and our mental processes. Thus, the sleepiness and mental hebetude which worry the "auto-intoxicated" are experienced by many people

after dinner, and certainly this is not due to the absorption of poisons, and Alvarez believing that it may be due solely to the distention and increased activity of the bowel, was able to induce sleep in a man with jejunal fistula simply by causing the intestine to contract actively on a small balloon inserted through the fistula.

Alvarez offers the sage advice that one must make sure that the symptoms complained of are really due to constipation and not to cardiovascular disease, tuberculosis, or something else. He ascribes in many cases constipation to nervousness and not nervousness to constipation. Many of the auto-intoxicated are undoubtedly psychopathic, and this type is hopeless, he believes. This paper, in the reviewer's opinion, is an outstanding contribution to the subject, and is a plea for truth as against mental kinks of the physician, intestinal of the patient. The suggestion that symptoms are due to mechanical distention and irritation may not meet with the approbation of the army of toxemiaphils but will certainly be a welcome suggestion for us of the anti-toxemia squad. As an editorial in the same issue of the JOURNAL remarks, "The medical profession will follow with more than academic interest the experimental development of a thesis so ably defended in this early presentation by one eminently fit to prosecute the work in the clinic as well as in the laboratory."

Catalase-Content of the Stomach and Intestine. Inasmuch as this article by Alvarez and Starkweather⁶⁴ and the one to be reviewed immediately following this abstract (*ibid.*, p. 67) have bearing on the Metabolic Gradient Underlying Intestinal Peristalsis, by the same authors, a brief note of its import will be given. Catalase is the ferment which liberates oxygen from hydrogen peroxide, and in a previous publication it was suggested that the catalase-content of a tissue might be used as an index of its metabolic activity. By studying strips of mucosa from various parts of the stomach from the cardia to the pylorus, the authors found that there was a definite gradation in the catalase-content from the cardia to the pylorus. There was a poorer gradation along the greater curvature, and the pace-making area near the cardia had a much higher catalase-content than that of the pyloric region where most of the muscular work of the stomach is done. Evidently the amount of catalase depends rather upon the speed with which a work has to be done than upon the amount of work to be accomplished. If Alvarez and Starkweather are correct in their assumption that the catalase-content of a muscle is an index of its metabolic activity, then the conclusion is warranted that there is a metabolic gradient in the stomach which underlies and accounts for the gradients of rhythmicity, irritability and latent period.

There is little difference between the pyloric muscle and that in the rest of the antrum, but there is an upward gradation in the first few centimeters of the duodenum before the downward gradient to the ileum begins. The duodenal cap which in man shows little activity and which has a tendency to remain filled during digestion has a comparatively

⁶⁴ American Journal of Physiology, 1918, xlvii, 60.

poor rhythmicity. Alvarez cautions against too strict adherence to the pacemaker theory of Keith, as one segment of the intestine does not influence the rhythm of the segment next it. "The bowel does not pulsate like a heart, and the word 'pacemaker' must be used with caution." An interesting observation is the reversal of gradients in sick animals which are vomiting or refusing food.

In the intestine, the gradation is generally upward from the pylorus to the middle or lower duodenum, whence it is downward to the colon. This is what is to be expected since the greatest digestive activity (intestinal) is in the lower duodenum and upper jejunum where the valvulæ conniventes and villi are largest and most numerous. There is comparatively little catalase in the colonic mucosa, and that is graded downward in the first two-thirds of the tube, and the low metabolic activity in this region is against the idea that colonic auto-intoxication is a common occurrence. Alvarez and Starkweather do not credit Burge's theory that a loss of oxidative power in the mucous membrane will lead to autodigestion by the contained ferments, for it is in the duodenum that the high catalase-content is found, and although the low catalase-content of the mucous membrane in the antrum might favor the formation of ulcer there, it is true that ulcers are often found well up on the lesser curvature where the catalase-content is high.

The authors comment on the occurrence of cancer at the points where the catalase-content is the lowest, namely the lesser curvature near the pylorus, and the splenic flexure. They suggest that these regions with the low rate of metabolism are probably most senile and are thus disposed to malignant change. The catalase-content may have to do with the immunity of the duodenal mucosa to cancer, primary and secondary to growths beginning in the stomach, since at the pylorus there is an abrupt change from a mucous membrane poor in catalase to one rich in catalase.

Metabolic Gradient Underlying Intestinal Peristalsis. "For many years physiologists have been teaching their students that food goes down the intestine because of Bayliss and Starling's law, or Cannon's myenteric reflex. According to this law, a stimulus applied to any part of the gut causes a contraction above, and a relaxation below. Interesting and important as this law is, it has a number of limitations, which, if better known, would undoubtedly have stimulated investigators to pry into the matter a little further or even to look for a new or more universally applicable law. Cannon himself has pointed out that the myenteric reflex is not always in control, and that 'it does not govern the rhythmic peristalsis and antiperistalsis of the colon and probably not the rhythmic waves of the stomach.' Since then Gaskell has shown that even the word 'reflex' may not be strictly applicable in this connection because recent anatomical studies have made it appear very unlikely that there is any nervous arc over which a true reflex would travel."⁶⁵ Alvarez recalls that six years ago, he noticed a great difference between the irritability of the duodenum or jejunum

⁶⁵ Alvarez and Starkweather: *American Journal of Physiology*, 1918, xlvii, 186.

and that of the lower ileum, and he felt convinced that this difference in irritability alone could account for the downward progress of food. It has been supposed that the rhythmic contractions were due to stimuli from the plexus of Auerbach, but it has been demonstrated that plexus-free strips will contract as well, even after several days, which would not be expected if it were a question of nerve cell functioning. Alvarez infers that the differences in rhythmicity, irritability and latent period must be ascribed to differences in rate of metabolism in the muscles of the different regions.

The work of Alvarez and Starkweather is eminently technical, and the steps by which they attain their conclusions need not be reviewed in detail. Suffice it to say that they studied the reactions of duodenum, jejunum, ileum and colon under the same conditions, varying them uniformly from time to time. They believe that metabolic gradient is at the basis of intestinal movements. Alvarez draws analogies in the heart impulse which has long been known to observe a gradient of rhythmicity. Also a similar law obtains in nerves which follow a gradient of CO_2 production along which the nerve impulse flows. In an efferent nerve the gradient is from the center to the periphery; in an afferent nerve the peripheral end has the greater CO_2 production and the gradient runs toward the center. Following this reasoning, Alvarez believes that the intestinal contents move aborally because of the aboral gradient of metabolism in the muscle.

It may be claimed that a greater amount of CO_2 is found in the duodenum because it beats oftener and does more work, but Alvarez replies that the same graded results were obtained with muscle that did not contract of themselves or were paralyzed with adrenalin. In fetal muscles the same law was found. Again it has been an experimental procedure which helps to prove Alvarez' theory, namely, the reversal of long stretches of intestines in dogs. With care, these animals have been kept alive for a long time but eventually all died with symptoms of intestinal obstruction, an indication that the direction of peristalsis had remained unchanged.

Were there no gradient, why is it that feces lie longer in the cecum or colon and are not shot on as is the material in the duodenum? Alvarez suggests that changes in the gradient of metabolism with symptoms of indigestion might be brought about (1) by a general depression of the body strength or by a general bacterial intoxication which would affect the duodenum more than the ileum, (2) by chronic passive congestion, as in heart disease, the duodenum suffering most from its poor oxygen supply; (3) by a local increase of blood supply, such as probably occurs in the colon in the presence of an inflamed, pregnant or menstruating uterus, and (4) by inflammations, such as appendicitis, which raise the local metabolism above its proper level.

Intestinal Obstruction. Each year in PROGRESSIVE MEDICINE, since 1912, some space has been devoted by the present writer to this important subject, and, on looking back over the past offerings, the chain of evidence points to some intoxication as the cause of death. Particularly does it seem that proteose (Rogere and Whipple) is the offender, and

particularly is it blamable when there is duodenal obstruction. This point is emphasized by Eisberg and Draper⁶⁶ who recently have been able to duplicate Whipple's experiments, and who have designated a point in the second portion of the duodenum "the true lethal line." Oral or aboral to this line there is a proportionate decrease of obstructive toxicity, a decrease that permits of expression in a mathematical ratio. This ratio is 1:4 in length of life and 1:8 in length of intestines, and an attempt is made to represent this in Fig. 12. The lethal agent is probably of biochemical origin similar to parathyroid or other endocrine secretions, interference with which causes death.



FIG. 12

Appendicitis. LUMBAR PAINFUL POINT IN ACUTE APPENDICITIS. Brun⁶⁷ calls attention to a painful point in the lower right lumbar region, associated with contraction of the muscles of the posterior wall. This point, when present, indicates a retrocecal appendix, which is not at all uncommon, being found by anatomists in 13 to 16 per cent., and by surgeons in 30 to 40 per cent. Brun has found the painful point mentioned above in 30 per cent. of his cases, and in all a retrocecal appendix was discovered. The exact location of the point of tenderness is

⁶⁶ Journal of the American Medical Association, 1918, lxxi, 1634.

⁶⁷ Presse médicale, January 16, 1919, p. 23.

above the right iliac crest in its lower portion, having its maximum intensity at the external angle of Petit's triangle. The importance of this point is that it gives one a valuable sign when palpation of the right iliac fossa is negative, and, furthermore, it gives the surgeon information about the location of the appendix, thus permitting him to make the appropriate incision.

APPENDICITIS AND JUXTA-PYLORIC ULCER. Roux⁶⁸ directs attention to the occurrence of two things in the course of appendicitis, painful gastropathies and duodenal or gastric ulcer. The first is fairly well known, but to the second has not been devoted so much publicity. The first complication disappears after operation but the second causes trouble following laparotomy, and eventually careful x-ray examination and the usual laboratory tests show the presence of a chronic ulcer. The first impression is that there has been an unfortunate coincidence of the two conditions, and then one begins to question the diagnosis. But Roux contends that the frequency with which the two are associated cannot be explained on the basis of pure coincidence, and it is far more reasonable to suppose that in addition to being the *fons et origo* of painful gastropathies, the appendicitis can be held as a cause of ulceration. He quotes several cases to prove this contention. The symptoms of duodenal or of gastric ulcer begin to be demonstrable either immediately following an attack of appendicitis or even weeks and months later. Furthermore, removal of the appendix is not followed by cessation of the symptoms as is the case with gastropathies, which are sometimes difficult to recognize, since at times they are accompanied by hematemesis with no evidence of ulceration. Roux believes that irritation of the appendix may cause a reflex pylorospasm and quotes Heldblom and Cannon to prove this. It has also been seen by Moynihan and Mayo at the time of operation and may by very intense irritation cause gastric stasis or may delay the emptying of the stomach (see article by White which follows immediately this review). Hypersecretion with hyperchlorhydria is frequently seen with appendicitis, so that of 122 patients operated, presumably for gastric trouble, 22 showed nothing but appendiceal trouble. (These figures must be considered high after reading the article by Cheney, quoted elsewhere.) Spasm and hyperchlorhydria, according to Roux, are essential for the development of ulcer. When hemorrhages are seen, they are due to a toxic necrosis of the mucosa, or to a retrograde embolus in the portal system arising from a clot in the appendiceal veins. Infection, too, may play a role, and to support this view the researches of Rosenow are invoked. Roux believes that the cause of gastric distress can be found in a diseased appendix, and even if there is true ulceration of the stomach or duodenum, the appendix should be examined at the time of operation.

Apropos of this article, there is one by White which may perhaps best be placed here inasmuch as it discusses THE EFFECT OF STIMULI FROM THE LOWER BOWEL ON THE RATE OF EMPTYING OF THE STOMACH.⁶⁹

Studies were made on cats and on men, using x-rays with both and

⁶⁸ Paris médicale, 1918, viii, 446.

⁶⁹ American Journal of the Medical Sciences, 1918, clvi, 181.

supplementing this with operative procedures in the animals followed by further roentgenological work. The first study was to note the effect of mechanical filling or distention of the colon, giving barium by mouth and by rectum. In men, bland rectal injections of 1000 to 1500 c.c. of potato gruel were given and retained as long as possible and in cats a similar injection with 30 to 40 c.c. There was little or no effect on gastric emptying. Food passed steadily through the pylorus while the enema was retained and the stomach was entirely empty within the usual time. During the first few minutes there was a slight delay in the action of the stomach, but that was all, and White states that this finding does not agree with Alvarez's conclusion that introduction of food into the lower end of the bowel markedly retards the passage of food from above. With reason, he argues, that because a patient vomits after rectal feeding, is after all poor evidence of reflex action from the colon to the stomach, for rectal feeding is usually given for previous vomiting. It is true that vomiting after rectal alimentation is the exception rather than the rule.

Studies of 200 patients with stasis in the ileum were made, with the conclusion that this condition was without effect on gastric emptying. He questions Barclay's theory of an ileopyloric reflex from the last coils of the intestine (ileum) to the pylorus, whose object it is to shut off the food supply by closing the pylorus until the ileum is more empty. White believes the pylorospasm seen by radiologists in chronic appendicitis is a variable finding, and that the more chronic and quiescent the appendix, the less likely it is to cause delay. He quotes Smithies to the effect that only 3 per cent. of pyloric spasms associated with appendicitis showed persistent gastric retention.

Chemical irritation of the bowel produced the following results:

1. Marked irritation caused either (a) delay in emptying the stomach up to about twice the normal time, evidently due to spasm of the pylorus, or (b) hyperperistalsis and rapid emptying of the stomach and the whole digestive tract.

2. Intense irritation caused prompt reverse peristalsis in the stomach with vomiting of the whole contents.

3. Moderate or slight irritation had no effect on the emptying of the stomach.

Clinically, White believes, delay in emptying the stomach after a barium meal is exceptional. In severe cases of chronic colitis there was no delay and the same was true of 3 cases of tubercular ulceration of the colon, and there was intense irritation of the bowel in these 3 cases, 5 cancers of the colon, 2 of the cecum and ascending colon, 2 of the transverse colon and 1 of the sigmoid were observed, and in none was delay noted. White believes in the importance of peritoneal involvement and also in the element of pain. Evidence indicates that the delay in gastric emptying is the result of impulses through the vagus causing pylorospasm, not inhibition of the motor fibers through the splanchnics. He says it is not fair to compare the intestine to a railroad under a block system when delay down the line holds up food for several blocks above, referring no doubt to Keith's theory of intestinal pacemakers.

He concludes by emphasizing the point that "stomach symptoms" in intestinal cases are not the result of slow emptying of the stomach as a rule, but are in the main toxic, or the result of referred pain or distress. When there is delay in emptying the stomach, the cause is far more often to be sought in lesions about the pylorus than in supposing it to be due to reflexes from the bowel.

ASSOCIATION OF APPENDICITIS WITH GASTRIC AND DUODENAL ULCER. A significant feature of Dubard's⁷⁰ article on the association of gastro-duodenal ulcer and appendicitis is the "*signe du pneumogastrique*," that is pain provoked by pressure over the course of the pneumogastric in the neck. Dubard has found this sign to be present in many classes of digestive troubles, and Huchon, his pupil, has seen fit to see in it a differential sign between ulcer and pyloric carcinoma. This pain is caused by neuritis, and Dubard believes this neuritis has an effect on the gastro-intestinal tract, provoking trophic disturbances, and, as a result, ulcer and other chronic inflammatory diseases or injuries of the alimentary tract. Dubard states that 80 per cent. of his patients operated upon for gastric ulcer were seized with pulmonary tuberculosis. Attention is directed by the author to the association of multiple affections of the gastro-intestinal tract—of 36 laparotomies for gastric ulcer the appendix was found diseased in 33 per cent.; 18 of 40 cases operated upon for duodenal ulcers had chronic appendicitis (45 per cent.). A curious instance of an abstract written by one unfamiliar with the English idioms is noted in the English abstract which is appended to Dubard's paper.

PATHOLOGY OF CHRONIC APPENDICITIS. There can be little difference of opinion among clinicians as to the meaning of the term "chronic appendicitis," according to Klotz.⁷¹ To the physician chronicity is a synonym of time, and, of course, etymologically the clinician is correct, although Klotz does not so state. The patient bears his complaint for months and years; often the complaint is neither greater nor less at his periodic visits to his physician, and in no sense can one say there is evidence that the individual is suffering from a lesion which is progressive or in which the inflammatory process refuses to come to a conclusion.

The pathologist does not think of the condition in terms of symptoms, nor is he concerned whether the patient has been suffering for months or years. To him the term implies an almost healed inflammatory lesion of the appendix which has had all the character of an acute or subacute reaction. The acute recurrent appendicitis has its chronic phase, hence the recurrent attacks tend toward cumulative chronic lesions, which in their late and almost healed state do not illustrate the multiplicity of recurrence.

This divergent use of the term chronic appendicitis has in a measure prevented a common understanding between the clinician and the pathologist. Klotz had classified the histological lesions of clinically diagnosed chronic appendicitis as (1) Recurrent appendicitis (with or without ulcer); (2) Subacute appendicitis; (3) Chronic ulcerative appen-

⁷⁰ Lyon chirurgial, 1918, xv, 356.

⁷¹ Medicine and Surgery, 1918, ii, 687.

ditis; (4) Chronic interstitial appendicitis; (5) Chronic and obliterative appendicitis; (6) Chronic peri-appendicitis (adhesions). Of a total of 5647 appendices examined, 1718 showed chronic interstitial lesions, 1689 had adhesions, 832 were obliterated, and 195 had concretions. Klotz has found chronic interstitial appendicitis and chronic peri-appendicitis twice as frequently in women as in men, occurring in greatest numbers between the ages of twenty and forty years. Chronic obliterative appendicitis is almost three times as frequent in women as in men. The age incidence in 2368 cases of chronic appendicitis is as follows:

1 to 10 years	2.0 per cent.
11 to 20 "	15.4 "
21 to 30 "	38.6 "
31 to 40 "	28.5 "
41 to 50 "	11.6 "
51 to 60 "	2.6 "
61 "	1.1 "

To understand chronic appendicitis, the lesion must be followed from the beginning. The acute stage is minute or large, superficial or deep, localized or spreading ulceration of the mucosa, and these lesions may, or may not, be associated with symptoms indicating the appendiceal origin. These ulcerations may be repeated without symptoms, and Klotz believes that the great majority of cases of true chronic appendicitis have suffered repeated inflammatory lesions of the appendix rather than that the late effects are the result of a single acute attack. He believes that appendicitis is of enterogenous origin and not a hematogenous infection. He likens it to tonsillitis in its pathologic features.

Various causes other than acute, subacute, and recurrent bacterial infection have been held as etiologic factors for chronic appendicitis, and French writers have repeatedly called attention to the oxyuria, but in America no great emphasis has been placed on this worm. Again, cecum mobile has in recent years received some consideration. It has been suggested that the viridans group of streptococci is the particular organism of appendicitis.

X-RAY FEATURES OF APPENDICITIS. Pfahler,⁷² in an article devoted to a plea for more complete roentgen studies, has dedicated much space to appendicitis, and although I have discussed a portion of his article elsewhere, it has seemed advisable to consider this part of his paper in this section.

Localized Tenderness. This most valuable sign is obtained either by palpation with the gloved hand under the screen, or by the "distinctor," a name applied to a wooden spoon-like instrument surrounded by a rim of metal. When the appendix contains barium or becomes visualized, the tenderness can be localized directly over the appendix and when the appendix is movable the localized tenderness frequently moves with it. Pfahler has moved the appendix as much as 3 or 4 inches, and in each case the sharply localized tenderness moved with the appendix.

⁷² Journal of the American Medical Association, 1918, lxxi, 1951.

This tenderness is persistent and is present throughout the studies made. A vague tenderness is more common when the appendix is retrocecal, in which case there is considerable soreness, but the tenderness is not sharply localized until one twists the patient in such a manner as to bring the pressure directly to bear on the appendix, when the pain may be quite acute. If there is no tenderness and the cecum is freely movable there is no appendicitis. If, on the contrary, there is tenderness with fixation of the cecum and no visualization of the appendix, it means that it is filled with inflammatory exudate. Pfahler believes that not too much reliance should be placed on tenderness over McBurney's point, for, if the appendix lies deep in the pelvis, there will be no tenderness (see Lumbar Painful Point in Appendicitis) and the same is the case if the appendix is located in the hepatic region.

Demonstration of the Appendix. Occasionally it may be demonstrated by the opaque enema, but more commonly by the opaque meal given in buttermilk. It can be seen in the majority of cases at the end of eight, twenty-four, and forty-eight hours, not always visible in plates but with the fluoroscope and the wooden spoon or "distinctor." To see the appendix if it is retrocecal, it is necessary to rotate the patient to the right or to the left sufficiently to bring the posterior surface of the cecum into view.

Fixation. A chronically inflamed appendix is apt to become attached to the surrounding structures. It may be attached only at its tip, in which case the greater portion of the appendix will be movable and yet the tip remain stationary. Or its tip may be movable and its base fixed, or it may be fixed throughout its entire extent. However, Pfahler warns, absence of fixation does not mean absence of inflammation, and in this instance the localized tenderness will be found of value.

Position of the Appendix. Normally the appendix is directed downward into the pelvis, and normally it is freely movable, and not only changes its position but its shape as well. Therefore, a chronically inflamed appendix may be found lying in a normal position in the pelvis, lying transversely or lying along the inner side of the ascending colon; or it may be retrocecal, or it may be even twisted around the pylorus. In general, when the appendix is directed upward or is retrocecal, it is more likely to indicate chronic appendicitis.

Kinking or Angulation. A mere bending of the appendix is without significance, for, as stated above, normally it changes its shape many times in the twenty-four hours, but a fixed angulation means adhesions.

Constriction. Any constriction, dilatation or irregularity in the lumen has a pathological significance. Pfahler undoubtedly means permanency of these changes but he does not thus express it.

Abnormal Retention. Importance is attached to the finding of barium after the cecum and ascending colon have become empty.

Spriggs⁷³ in the main gives practically the same opinion about the value of the x-ray studies of the appendix as does Pfahler, but his points of importance arranged in the order of their value are not quite the same

⁷³ Lancet, 1919, excvi, 91.



FIG. 13

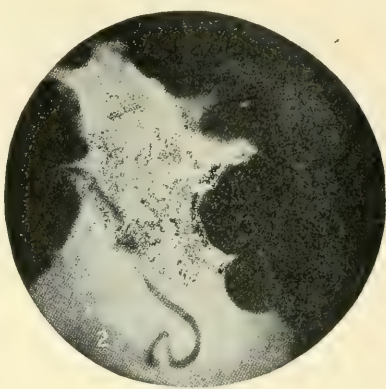


FIG. 14

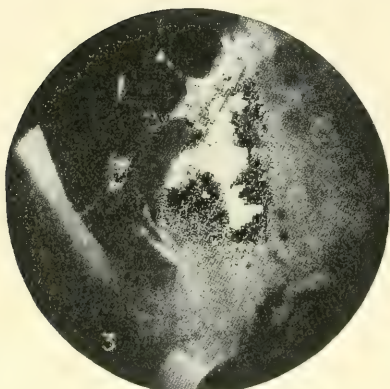


FIG. 15



FIG. 16

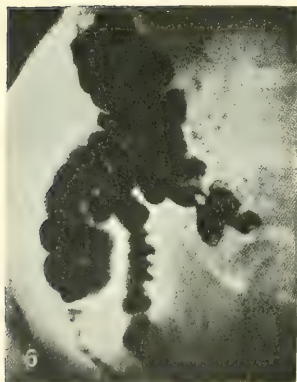


FIG. 17

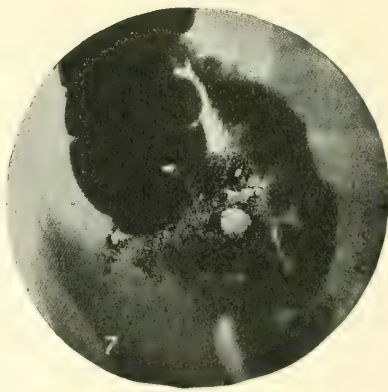


FIG. 18

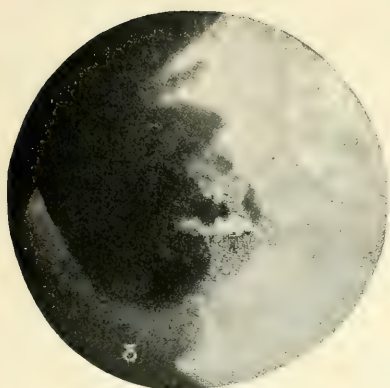


FIG. 19

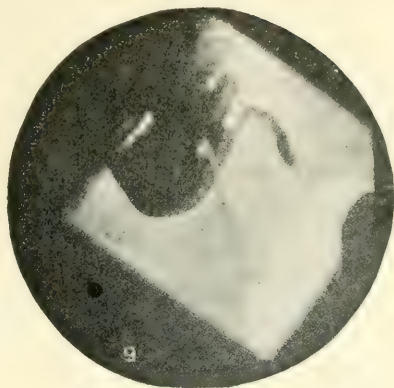


FIG. 20

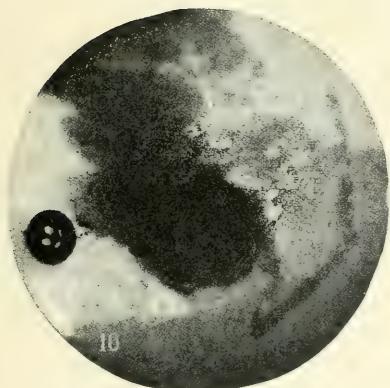


FIG. 21

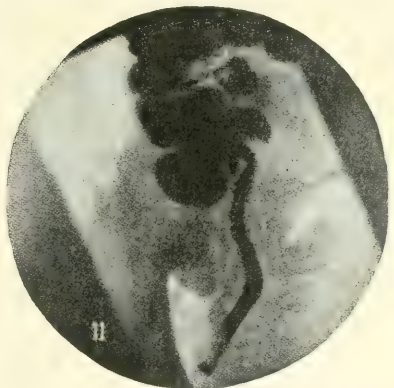


FIG. 22

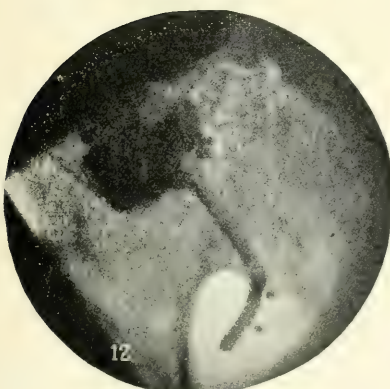


FIG. 23



FIG. 24

as Pfahler's. Spriggs' are: (1) The filling or emptying of the appendix—delay or stasis; (2) shape—constriction and dilatation; (3) fecal concretions—vacuoles; (4) mobility; (5) hyperactivity—spasm; (6) tenderness; (7) position. Thus it will be seen that localized tenderness, upon which Pfahler places so much reliance, is next to the last in importance in Spriggs' opinion.

Before taking up these items, let us consider Spriggs' conception of the normal appendix, a conception which, be it said, seems to be based on the studies of the American school, as represented by Case, George, Gerber and Leonard. The illustrations reprinted from Spriggs are frequently referred to and may with profit be consulted during the reading of this review. In health, the shadow may vary in width from $\frac{1}{4}$ inch down to a thread (Figs. 13, 17, 20, 22 and 23) or a row of dots (Fig. 15), the lumen may be seen to fill and to empty several times, especially in young people, finally emptying at the same time as the cecum. Before deciding that the appendix is diseased, clear evidence must be obtained of natural position, mobility and outline of the appendix and surrounding parts, of a natural rate of filling and of emptying of the ileum and cecum; of the absence of tenderness to direct pressure; and of pain and any symptom of appendiceal disease. The distal part of the appendix should be movable within the limits of its attachments and the whole should move freely with the cecum. The outline of the healthy appendix should show no constant irregularities.

According to Spriggs, the appendix begins to fill, three to four hours after the meal has been taken, and in a few minutes may fill from end to end. However, the filling is frequently quite slow and it may not take place for some hours after the cecum and ascending colon are filled. In some cases, with rapid filling, the material that enters appears of the same breadth throughout (Figs. 21, 22 and 23) and in others temporary constrictions may be seen (Figs. 14, 16 and 19). Sometimes the appendix fills and empties itself repeatedly within a few seconds, and this generally occurs in young people; or it may fill and empty at a slowed rate several times in the course of a few hours.

The width of the lumen varies in different appendices and in the same individual. It is usually fully relaxed after fresh material has entered and becomes constricted later on (Figs. 40 and 41 taken at an interval of thirty seconds). It bears no relation to the size of the cecum and ascending colon. It is usually narrowest at the base (Figs. 17 and 19). The time for the best view is usually about twelve to fourteen hours after the opaque meal, but there are wide variations in this respect.

The appendix remains filled until the cecum is empty and then its contents are discharged. The density of the appendiceal shadow lessens as the cecum empties (Fig. 21). In some cases, where there is no evidence of disease, the contents remain longer, *i. e.*, until the ascending colon is clear. Beyond this delay the appendix is regarded as sluggish. In some cases the tip may be seen to have a snake-like motion (Figs. 18 and 19) presumably from the passing in of material or from active contractions of its wall.

Regarding the statement that the appendix tends to become obliter-

ated with age, Spriggs says it is not a necessary accompaniment of advancing years, for in one healthy subject of seventy-four years, the diameter of the appendix was greater than in many young people (Fig. 21).

The Diseased Appendix. No x-ray is needed for acute appendicitis but in the diagnosis of chronic appendicitis it is a method of great value, particularly in those cases where there is digestive trouble of unknown cause. It is sometimes possible to make a diagnosis of chronic appendicitis from x-ray findings in the ileocecal region other than direct observations of the appendix. Such findings are adhesions of parts, ileal stasis, insufficiency of the ileocecal valve, and spasticity of the colon. Reference has been made to Spriggs' seven points of importance in the direct examination of the appendix and fuller discussion of these now follows:

1. *The Filling or Emptying. Delay or Stasis.* The appendix may admit of no barium, but this is rarely the case if the bowel has been thoroughly purged. Constriction near the base accounts for some of the instances in which the appendix is not seen (Figs. 38 and 39). Spriggs does not conclude that an appendix is abnormal because it does not fill, but nevertheless he regards it with suspicion. Most frequently in chronic appendicitis it fills in part (Figs. 24, 27 and 29), the passage of barium being blocked, sometimes by obliteration (Fig. 31 and colored drawing, Case 8), or constriction or kinking (Fig. 28), but generally by stagnant inopaque material (Figs. 24, 27 and 29) which the appendix has been unable to expel owing to limitation of movement by inflammation or its results.

Such interference also prevent the punctual discharge of any barium which has entered, so that the appendix may retain its contents for twelve, twenty-four or more hours longer; in one case of Spriggs it remained for twenty-six days. In cases of moderate appendiceal stasis without irregularity of outline, uneven filling, immobility or tenderness he does not recommend excision. If the shadow is very fine and the appendix rigid there is probably a fibrous atrophy.

2. *Shape, Constrictions and Dilatations.* Irregularity in the outline of the shadow is, next to uneven filling, the commonest sign of a diseased appendix. Repeated photographs alone show if the irregularities are persistent and not due to normal contraction waves. Many forms of dilatation and constriction are shown in Figs. 24, 28, 30, 32 and 33 and in the colored illustrations.

3. *Fecal Concretions. Vacuoles.* Concretions, if of long standing and infiltrated with lime, cast a shadow (Fig. 25), and such a shadow may be confused with calculi in the urinary tract. It is usually a symmetrical oval, distinguished thereby from glands and phleboliths. The lumen proximal to an old concretion is often bent into a sharp hook, and this deformity (Figs. 25, 29 and 33) should suggest the possibility of a concretion. More recent concretions, which may cast no shadows of their own, may block entirely the passage of barium, and in these cases the hook-like deformity assumes much importance. In Figs. 27 and 29 concretions lay in the distal part of the appendix, and did not



FIG. 25

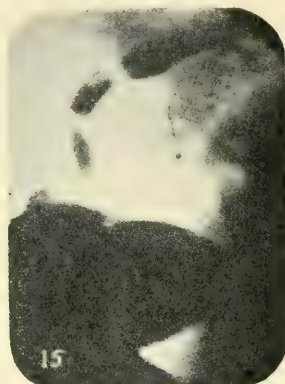


FIG. 26

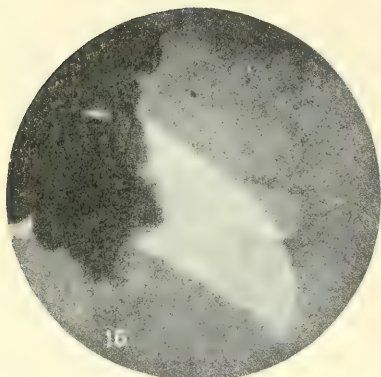


FIG. 27



FIG. 28

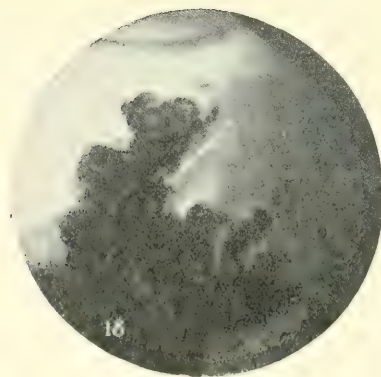


FIG. 29

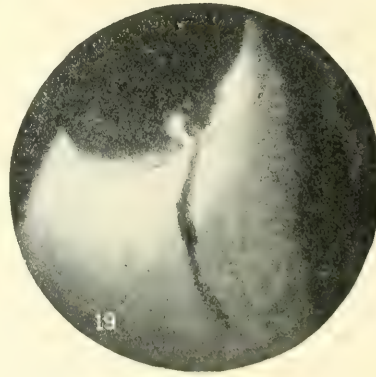


FIG. 30

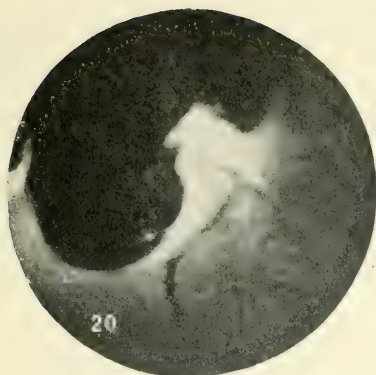


FIG. 31

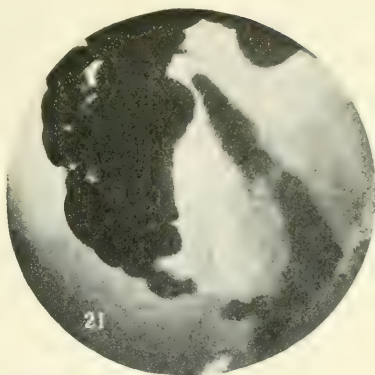


FIG. 32



FIG. 33



FIG. 34



FIG. 35

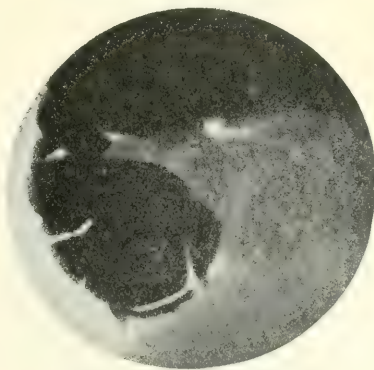


FIG. 36



FIG. 37

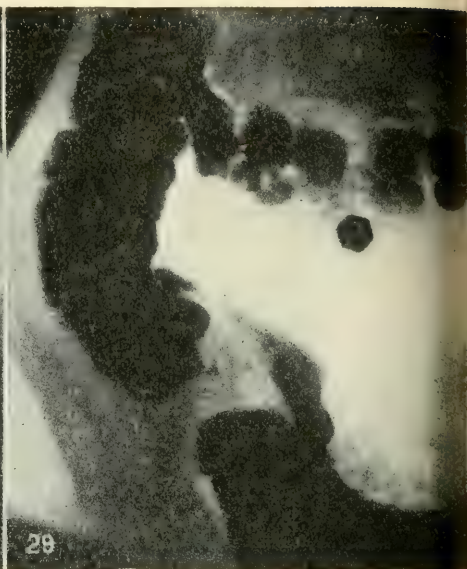


FIG. 38

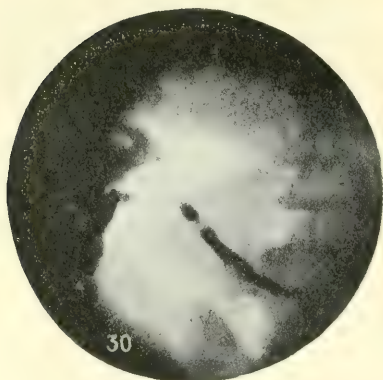


FIG. 39

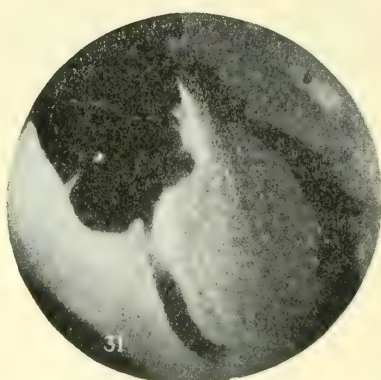


FIG. 40

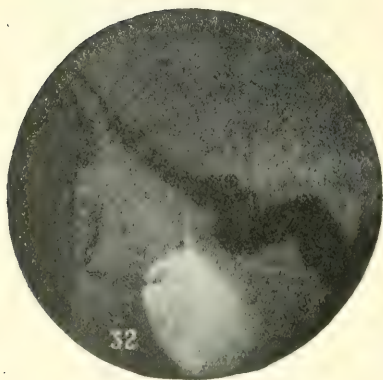


FIG. 41

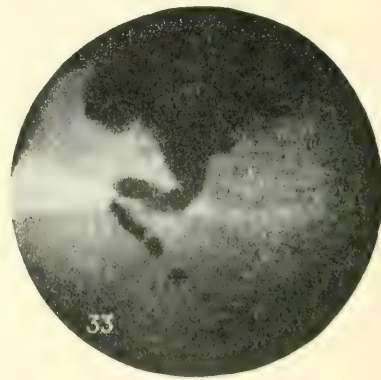


FIG. 42

show in the photographs. In many cases the barium passes round a soft concretion, giving it the appearance of a vacuole (Figs. 24, 28 and 29), while in other cases the barium extends around the proximal part only of the concretion, giving a V- or cup-shaped shadow as in Fig. 24.

4. *Mobility.* When the appendix cannot be moved within the limits of its attachments, adhesions should be suspected, but if the cecum and appendix lie in the pelvis, mobility cannot be determined unless those organs can be brought into the iliac fossa. (Cf. Pfahler for method of doing this.) It is most often adherent to the iliac fossa, the ileum, the cecum or in the pelvis. The appendix may fill with barium, even when it is bound down for its whole length (Fig. 35). Sharp kinks must be carefully noted, but for their recognition several plates are required (Figs. 36 and 37).

5. *Hyperactivity. Spasm.* The normal filling and emptying movements of the appendix are vigorous and rapid, but when there is inflammation in the region of the appendix they are markedly intensified (Fig. 39). Figs. 27 and 39 are photographs of appendices during contractions. This pathologic activity differs from the normal in being continuous for hours during the filling period, and it has been seen to persist for twenty-four and thirty-six hours. The normal movements are only seen through the good luck, so to speak, of happening to observe the appendix at the right moment. The block of material in the normal appendix also shows as a rule a symmetrical tapering of each end (Figs. 14 and 16).

Spasm is another characteristic of an inflamed appendix. A portion remains constricted for a considerable time, the blocks of opaque material being cut off abruptly (Figs. 26, 34 and 42), whereas when they are being moved on by waves of contractions they have tailed or rounded ends. Slight or varying dilatation of the lumen is nearly always present, too. Concretions, as a rule, cause no spasm.

6. *Tenderness.* This may be a valuable and unequivocal sign of appendicitis. Spriggs places this almost last in importance; Pfahler considers it of intense value, and it will be of interest to compare the opinions of these two roentgenologists. An enlarged part of the appendix is frequently, although not always, painful on pressure, but tenderness, taken alone, is of less uniform significance than is generally expected, and it is not safe to make a diagnosis of appendicitis in the absence of the more important signs mentioned above. If direct though gentle pressure is made upon the base of the appendix, pain is often felt, usually at the spot pressed upon, but sometimes in the left side of the abdomen, and it must never be forgotten that the patient's temperament and general condition should be considered in interpreting this sign. Spriggs quotes an instance of an incorrect diagnosis due to much emphasis being laid on this point.

7. *Position.* The position of the appendix depends upon the position of the cecum. The position of the appendix in relation to the cecum may vary a great deal, and an unusual position is not necessarily evidence of disease. In 49 cases described or illustrated in Spriggs' paper, there were 7 retrocecal appendices; of these, 5 gave evidence of deficient filling or discharge or other abnormality.

The Chronic Intestinal Invalid. That *bête noir* of all dispensaries, the "Chronic Intestinal Invalid," has at last received some consideration from John Bryant, of the Peter Bent Brigham Hospital. He has established there a clinic where all the chronic gastro-enteritides are made welcome and where much, it seems, is being accomplished by psychotherapy plus exercises. His papers, of which there are two⁷⁴ are scarcely suitable for this review but the reader is referred to them for enlightenment as to how this difficult class of patients has been fairly satisfactorily handled.

Importance of a Complete Roentgen Study of Gastro-intestinal Tract and Gall-bladder. By the term "complete study," Pfahler⁷⁵ means investigation of the gall-bladder region for gall-stones, enlargement and adhesions; a study of the stomach to prove that it is either normal or abnormal, and, if abnormal, in what respect it is abnormal; a study of the duodenum; a study of the head of the pancreas; a study of the appendix and the appendiceal region; a study of the colon, and very often it is advisable to make a study of the spinal column and of the urinary tract. Pfahler allows at least forty-eight hours for one of these studies. At 9 P.M. preceding the examination, the patient is given a purgative and reports the following morning at 9 o'clock, having eaten no breakfast, at which time a study of the bladder, ureters and kidneys is made. Then several plates are made of the spine if there seems to be any indication of disease in this region, after which from six to eight plates are made of the gall-bladder region and the patient taken to the fluoroscopic room. The entire chest with its contents is studied, and the abdominal cavity is inspected. An opaque meal is then given and its course down the esophagus observed and its transit into the stomach noted. Unfortunately, so far Pfahler takes us with his technic and no further. He fails to inform us when he makes his plates, at what intervals for the various conditions; in fact, he leaves us in the fluoroscopic room after 9 A.M. and we know not what becomes of the patient during the forty-eight-hour examination.

Stomach. Denying that there is uniformity in the position, outline and shape of the stomach, he does not tell us what he regards as pathologic, as does Cheney in his article. He states that variation in the form and position of the stomach may be of some clinical significance, but cannot of themselves be looked upon as pathologic.

The pylorus should have a line of sphincter one-eighth of an inch in width and the gastric and duodenal surfaces should be smooth, otherwise the pylorus cannot be said to be normal. A smooth duodenal surface with a jagged gastric surface should lead one to suspect cancer. When there is any doubt, a large series of small plates or multiple exposures should be made. If Pfahler sees clearly the outline of the wall of the stomach and normal peristaltic waves, and everywhere smoothness and regularity of movement, he makes no plates.

The duodenum is studied for its position, outline, peristaltic movements and filling defects and when this is done, 95 per cent. of duodenal

⁷⁴ *Medicine and Surgery*, 1918, ii, 625 and 634.

⁷⁵ *Journal of the American Medical Association*, 1918, lxxi, 1951.

ulcers should be recognized. A filling defect or an irregularity about the duodenum does not always mean duodenal ulcer, for the same may be found in adhesions or spasm. A fixed indentation or niche of the first part of the duodenum, together with contraction of the entire duodenum, bespeaks ulcer. Many plates should be made in doubtful cases.

The Gall-bladder. Pfahler is one of the American School of Roentgenologists who believes that gall-stones are readily diagnosed by the *x*-rays, perhaps not so frequently as George and Case, but nevertheless in about 75 per cent. of the cases. The detection of gall-stones depends chiefly on their composition, but also in the absolute stillness of the gall-bladder, the amount of tissue overlying it, and the contents of the gall-bladder. A bladder filled with fluid may permit of no outline of gall-stones. Adhesions in the gall-bladder are indicated by abnormal attachments of the surrounding organs, and especially characteristic is the hooking up of the duodenum, thereby changing the position of the stomach. One cannot recognize the actual adhesions, only the effect.

Appendiceal and Cecal Regions. The most favorable time to study the appendiceal region and its contents is at the sixth-, eighth- and twenty-four-hour period. At times one may see the appendix filled at the end of six hours, and empty at any other time, and when it is filled, one can localize its position and determine its mobility or the presence of adhesions. Pfahler discusses then at length the diagnostic features of appendicitis, and his views will be found in the section devoted to appendicitis.

Unusual Types of Diarrhea. Brown⁷⁶ presents the following group representing certain unusual types of diarrhea (increase in frequency and diminution in consistency of the stools):

1. *Gastrogenous Diarrhea.* This type is seen in achylia gastrica, and the cause thereof is shock or nervous strain on the one hand, and gastritis of long standing, with buccal or dental disease, on the other. Brown has not found any evidence to support Gross' idea that this type is pancreatogenous in origin, nor does he credit Nothnagel's belief that the diarrhea represents an irritative enterocolitis. He believes that the hydrochloric acid probably plays a definite role in the elaboration of a peristaltic or anti-peristaltic hormone, and that, etiologically speaking, these cases are due to an increase of the normal peristaltic stimuli of hematogenous origin.

2. *Diarrhea in Graves's Disease.* In some cases the well-known associated diarrhea seen in Graves's disease may be the only symptom of this condition, and Brown discusses this particular class of cases. In these, he sees thyreogenic disturbance of nerve impulses as the prime cause of the diarrhea, due either to vagal stimulation or splanchnic inhibition. He suggests the possibility of some pancreatic disturbance. Into this class fall undoubtedly many cases of so-called nervous diarrhea, but these may be due to disturbance of adrenal function. It would be interesting to learn which of the four causes Brown has been careful to

⁷⁶ Medicine and Surgery, 1918, ii, 640.

enunciate is the cause—vagal stimulation or splanchnic inhibition, or pancreas or adrenals? He has given us a wide choice.

Diarrhea after Cholecystectomy. Such cases as have been seen by Brown showed normal gastric juice. Ferment studies of the stool showed absence of diastase and trypsin suggesting a pancreatogenous origin, and hence leading to successful treatment with pancreatin and lime salts.

Diarrhea in Tabes. Diarrhea here is periodical and probably neurogenic, due to overstimulation of the vagi or inhibition of the splanchnics.

Diarrhea in Sprue. In these cases there was absence of trypsin and diastase, due probably to organic or functional disturbance of the pancreas. Pancreatin cures here as in the diarrheas following cholecystectomy.

Diarrhea in Appendicitis. Diarrhea occurs in children in the acute cases with long appendix situated in the pelvis (rectal examination useful), and in adults with chronic or subacute appendicitis. The diarrhea disappears after appendectomy.

Diarrhea in Ulcerative Colitis, Sigmoiditis and Proctitis. Brown believes these cases are due to some bacterium or protozoön capable of growth only under anaërobic conditions since appendicostomy cures.

Occult Blood. Grégersen⁷⁷ states that the feces of normal people, even on a meat-free diet, contain from 0.03 to 0.005 per cent. of blood, hence he does not recommend the phenolphthalein and thymolphthalein tests. He has modified the benzidin test so that its sensitiveness can be controlled by the strength of the solution. He uses a powder consisting of 2.5 cg. benzidin and 20 cg. barium peroxide, in waxed papers. When ready to use, one of the powders is put into a measuring glass and on top of this is poured 5 c.c. of a 50 per cent. solution of acetic acid. A 0.5 per cent. solution of benzidin is thus obtained in which the necessary proportion of hydrogen peroxide is generated as the barium peroxide is dissolved by the acetic acid solution. The portion of feces, about the size of a hemp seed, taken from the center of the mass, is spread in a thin layer on a slide, and from 2 to 4 drops of this reagent are dropped on it. If the specimen turns a greenish blue, a pale blue, in the course of from fifteen to sixty seconds, the specimen contains blood in a proportion of about 0.2 to 1 per cent. If the tint is a livelier blue, and the change in tint occurs in from three to fifteen seconds, the blood-content of the specimen is about 1 to 5 per cent. With a still more rapid change of tint and a darker blue, the blood-content is over 5 per cent. Two or three drops of the reagent are required for one drop of urine. He has found persistent occult bleeding one of the very earliest symptoms of cancer. With gastric ulcer the bleeding comes and goes, but never keeps up long. Negative findings for a few days disprove the assumption of cancer.

The thought that naturally arises is, what value have these analyses of the quantity of blood in the stools? Is there any diagnostic significance to be attached to blood in 1 per cent. or 5 per cent. concentration?

⁷⁷ Abstract, Journal of the American Medical Association, 1918, lxxi, 158.

Should it be true that blood, as Grégersen states, is always present in small amounts, a solution of benzidin may be used which does not respond with this so-called normal blood, but reacts only when the concentration of blood in the feces is present. Furthermore, the technic of using benzidin powders seems to be no more advantageous than the benzidin tablets long since recommended.

There is recently an endeavor to throw discredit on the presence of occult blood as a sign of ulcer or cancer. In Koopman's⁷⁸ experience occult blood was found in but 2 of 17 cases of duodenal ulcer, and in but 3 of 7 cases of gastric ulcer. It is possible, he believes, for an ulcer to bleed a little and the blood to become disintegrated and absorbed before it reaches the anus. This suggests to him the possibility that the whole benzidin reaction may be merely an indication of the presence of demolished albumin, and the blood reaction merely a special form of it. He is inclined to the belief that, on the whole, the significance of occult blood in the stools is slight and is more often liable to lead to false than to correct conclusions. He refers to the spectroscopic method of Snapper, which I find has been abstracted in the *Journal of the American Medical Association*, 1919, lxii, 837. Snapper expatiates on the importance of spectroscopy for determining occult blood, in fact he says it is the only dependable method, since the color reactions are not reliable, peroxidases in the absence of blood being liable to give positive reactions while the blood may be absorbed in the intestinal canal (see above) and none reach the anus or be eliminated in a porphyrin combination. I notice that in the recent literature on the benzidin test the question of peroxidases and ferments in general are not frequently mentioned. These should be always in mind as a possible source of error, and it was recommended in a very early paper⁷⁹ on this subject that the feces be boiled to get rid of these disturbing factors. Snapper determined either hemochromogen or porphyrin, and it is when blood is in the latter form that all tests for occult blood are negative. All the hemoglobin may be transformed into this hemato-porphyrin combination, even when there may be considerable blood in the digestive tract. Unfortunately, the technic of preparing the feces for spectroscopic examination is not given in the abstract, but the method seems to remove certain criticisms attached to those tests depending on color reactions for their end-result.

TEST FOR OCCULT BLOOD. Thevenon and Rolland⁸⁰ have devised a test based on the reaction which pyramidon gives in the presence of oxidases. Two reagents are required:

No. 1	
Pyramidon	2.5 grams
Alcohol (90 per cent.)	50.0 c.c.
No. 2	
Glacial acetic acid	1.0 c.c.
Distilled water	2.0 c.c.

and, in addition, oxygenated water (12 volumes).

⁷⁸ Abstract, *Journal of the American Medical Association*, lxxii, 1919, 317.

⁷⁹ *American Journal of the Medical Sciences*, October, 1907.

⁸⁰ *Presse médicale*, August 15, 1918, p. 425.

A small portion of feces is triturated with 3 to 4 c.c. of distilled water, decanted and 3 to 4 cm. of pyramidon are added and 6 to 8 drops of acetic acid, then 6 drops of oxygenated water. In the presence of blood, one will see a bluish or violet coloration, more or less intense, depending on the quantity of blood. Comparisons with phenolphthalein have shown that this new reagent is as delicate, and the authors enthusiastically urge its adoption as a clinical test. The fact that it is as delicate as phenolphthalein scarcely recommends it, if we are to believe that normal stools contain blood which may be recognized by this reagent. For simplicity, I have yet to find anything less onerous than the benzidin test.

PRECIPITIN TEST FOR BLOOD IN FECES. Liquid feces are filtered directly through fine filter paper while solid or semi-solid feces are mixed with 0.9 per cent. salt solution and filtered through a Buchner filter. If acid, it is neutralized with dilute sodium hydrate solution; if alkaline by means of dilute hydrochloric acid. Chloroform is added to restrict bacterial growth, and rapid centrifugation clarifies the extract. The tests are made in small tubes, a small quantity of extract is placed therein and about 0.1 cm. anti-human rabbit-serum introduced at the bottom by means of a capillary pipette, so as to get a precise line of contact. The tubes are kept at room temperature, and the result read at the end of an hour. In most of the positive reactions, there is a well-defined precipitate in the form of a grayish layer at the junction of the extract and serum. The anti-human serum is usually 12,000 in titer; in other words, it causes a precipitate in about ten minutes with dilution of human blood 1 to 12,000 in salt solution.

Hektoen, Fantus and Portis⁸¹ do not recommend this method as a test for occult blood, but state that it may be useful when the precipitin test is negative and the benzidin test is positive, as indicating that the benzidin reactions was not caused by human blood. An interesting observation is that extracts of healthy men on unrestricted full meat diet, only very exceptionally give positive reaction with antibeef, anti-sheep, antiwine, and antichickens sera, which shows that, in health, foreign proteins taken into the stomach as a rule do not reach the feces as such.

Soluble Albumin in the Feces. Labbé and Canat⁸² quote the German writers to the effect that the presence of soluble albumin, in the feces of adults, always indicate a pathologic condition. It does not arise from ingested food, but always from ulceration of the intestine, and occurs in the enteritides, colitides, typhoid fever, cholera, abscess and tuberculosis of the intestine, amyloid disease, peritonitis and in stools following purgation.

For the detection of soluble albumin, two methods are used, but precipitation by heat and acetic acid is the more delicate: (1) *Precipitation by heat.* A small portion of fresh stool is ground in a mortar with distilled water and filtered two or three times until the filtrate is clear. To this are added a few drops of acetic acid and if there is a precipitate,

⁸¹ Journal of Infectious Diseases, 1919, xxiv, 482.

⁸² Presse médicale, September 26, 1918, p. 499.

nucleo-albumin or mucin is present, which must be filtered off, and if there is no more cloudiness on the further addition of acetic acid, it is certain that these disturbing agents have been removed. The solution is then boiled and tested for albumin as in the case of urine. (2) *Precipitation by mercury and acetic acid.*

Corrosive sublimate	3.5 grams
Acetic acid	1.0 c.c.
Distilled water	100.0 c.c.

A portion of stool is mixed with equal parts of the reagent and the two agitated in a test-tube and allowed to stand from fifteen minutes to two hours. If there is no albumin, the feces collect in the bottom of the tube and the supernatant liquid remains clear, whereas, if albumin be present, the fecal particles are held in suspension throughout the mixture.

It is never found in normal stools, and Labbé and Canat believe it has an important prognostic significance. For instance, nucleo-albumin and mucin, or the precipitate obtained by the addition of acetic acid to the filtrate in the cold, is found very frequently, and always is present when soluble albumin is detected. By this is not meant that it is found only when soluble albumin is present as it occurs in its absence, but it is never absent when albumin is present. Therefore it has a less ominous prognostic significance than soluble albumin. The authors, using the phenolphthalein method, believe that occult blood has less significance than soluble albumin, since slight ulceration may give blood, whereas only deep ulceration exhibits soluble albumin.

Enteroneuritis. Loeper⁸³ calls attention to the fact that there is scarcely any enterologic condition, however acute and transitory it may be, that may not result in intestinal troubles of a more permanent nature. Typhoid fever is responsible for rebellious diarrheas and atonies, dysentery and all sorts of enteritides may be followed by spasmodic conditions or persistent mucorrhea. The origin of these disorders may be found in an alteration of glands, in an inflammation of the intestinal mucosa, in hepatopancreatic dyspepsia or in an enteritis. He believes that the cause can perhaps be discovered in a nervous change or in a true neuritis. Celiacgia, neuralgia, or solar neuritis, may explain certain painful phenomena, but in this paper he directs attention to lesions or irritations in the true nervous system of the intestine, which are at the bottom of diarrhea, constipation, spasm and pain, arrhythmia of the intestine analogous to arrhythmia of the heart, which he includes under the name of enteroneuritis.

After describing the anatomy of the nervous system of the intestine, he discusses the histologic findings in 36 cases, including dysentery, typhoid fever, colitis, duodenal ulceration, and enteritis, syphilitic and tuberculous. The lesions he has found can be classified as degenerative, inflammatory and fibrous in character, and are found most easily in the large intestine.

⁸³ Bull. de la Soc. méd. des hôp., 1919, xxxv, 196.

Degenerative changes are found in colitis and acute enteritis, and are the result of a rapid, virulent, and what Loeper calls, "brutal process." They are found, too, in typhoid and paratyphoid fever, in choleraic conditions and in true cholera. They are seen to greatest advantage in Peyer's patches, extending 3 cm. from these. They may occupy all the ileum and all the small intestine. The nerve-fibers are seen to be broken up and dissociated, and fatty changes may be observed. The cells are homogeneous, edematous and the contour is lost. The greater part of the granulations are gone. The chromatine partly disappears, and the nuclear mass being completely disintegrated, appears as a vacuole.

Inflammatory lesions are seen in typhoid fever, but they are especially encountered in subacute or less penetrating processes, duodenal ulcerations, ulcerative colitis, dysentery, and tuberculosis. Typically, the lesion is one of leukocytic infiltration and connective-tissue proliferation, the first being easily recognized but the latter seen only with difficulty. Leukocytic infiltration takes place into the interior of the nerve sheath or capsule of the ganglion, and extends into the ganglionic stroma and even the cell. The capsular cavity is distended by the leukocyte-invasion. The leukocytes are of the polynuclear variety in the acute condition but in greater number are the round cells which form a complete ring about the ganglion or nerve. When the capsule bursts the leukocytes are discharged into the neighboring muscle. In tuberculosis and in syphilis, veritable nodules are thus formed similar to those in the pia mater. Duodenal ulcer and dysentery favor the diapedesis of eosinophils. The connective-tissue reaction is indisputable, but is difficult to see. It is found on the surface of the ganglion or of the nerve trunk, and in the wall of the nerve sheath, and is caused by proliferation of elongated cells.

When this connective-tissue proliferation is well-marked, it constitutes the third variety—fibrous lesion. It is seen in chronic dysentery and in tuberculosis.

Loeper ascribes to these nerve changes a large part in the production and persistence of certain functional troubles. In the course of an intestinal trouble, it is rather difficult to ascribe diarrhea, mucus, pain and atony to a lesion of the nervous system. Changes produced by nervous irritation may be confused with those due to ulceration or inflammation of the mucosa. However true this may be, during the time when there is no lesion, following a supposed cure, the nervous element asserts itself. It intensifies disorders in defecation, it modifies the conditions of secretion and of absorption, and it accentuates pain.

In a paper appearing in the same number of the *Bulletins et Memoires de la Société Médicale des Hôpitaux*, page 203, Loeper describes enteroneuritis in intestinal cancer. He calls attention to the attacks of pain, resembling tabetic crises, which occur in cancer, and which, in 2 cases reported by him, were caused by extension of the neoplastic process into the nerves of the mesentery and into the solar plexus. This extension takes place through the nerve sheath, and in time there is absolute destruction of the nerve itself. This neoplastic celiacgia (*coeliacgie*

néoplastique) he believes explains certain of the painful phenomena associated with cancer.

Diverticulitis of the Colon. Erdmann⁸⁴ in the past has written extensively on this subject and in this his latest paper will be found his present views, based on 30 patients whom he has seen.

Symptomatology. The patients are usually well-preserved, and the chief complaint in the majority was occasional sense of soreness or distress in the left lower quadrant and hypogastrium. The stools contained neither mucus nor blood. There is a tendency to constipation, occasionally dysuria and frequency, and when attacks are complained of they are similar to the mild attacks of pain in the right lower quadrant when the appendix is diseased. Proctoscopically, nothing is found, but with the *x*-ray considerable help has been obtained.

The differential diagnosis rests between the rare but possible left-sided appendix, and carcinoma. A point to remember when deciding between diverticulitis and carcinoma is that the former occurs with preference in young individuals while carcinoma is a disease of advanced years. Furthermore, cancer gives rise to mucus and blood in the stools, singly or combined, alternating diarrhea and constipation, loss in weight, anemia, prostration, and cachexia, a chain of symptoms and objective findings not seen in diverticulitis. If the tumor is within 12 or 15 inches of the anus, evidences of mucous membrane invasion of the canal will be found.

Terminations of Diverticula. These may be subacute, acute or chronic, with thickening and obstructive symptoms, and, finally, carcinomatous implantation. The subacute conditions have been considered as those of an irritable and recurring appendicitis, and are probably due to overdistention of the pouch with fecal material, or an irritation by some foreign substance. The acute manifestations include all the signs of an appendiceal attack. The chronic type is due to a recurring condition or chronic irritation.

Gross Pathology. On sections of the epiploön near, or at, its base, a diverticulum is usually found, these pouches or bodies being round or ovoid and range from the size of a pea to the size of an egg. The open colon has the appearance of a healthy mucous membrane thrown into folds, with here and there a crypt or long opening into which an instrument of considerable size can be passed. Occasionally, foreign bodies are found in the diverticula.

Etiology. Erdmann quotes Hartwell and Cecil as saying, "We, therefore, are driven to the conclusion that up to the present time no complete explanation of the primary cause of intestinal diverticula has been offered. The most that can be said is that for some cause a weakness exists in the intestinal coats, and by reason of the weakness a pouching of the coats takes place when undue pressure arises." Erdmann seems content with this statement, although he reviews briefly other explanations of the causation of these anomalies.

⁸⁴ New York Medical Journal, 1919, cix, 939.

The Effect of "Ground Glass" on the Gastro-intestinal Tract of Dogs. Simmons and von Glahn⁸⁵ state that despite the many reports of so-called "glass poisoning" appearing in the newspapers and spread by individuals, they have found no authentic case due to the ingestion of glass in any form or size. They have taken pains to feed dogs with glass in various degrees of comminution but have been able to produce no lesion, either gross or microscopic on the gastro-intestinal tract of dogs.

DISEASES OF THE LIVER AND GALL-BLADDER.

Cirrhosis of the Liver. *Etiology.* Urrutia,⁸⁶ in looking over the records of 60 cases of cirrhosis in adults, found abuse of alcohol in 35 per cent., but in 39 per cent. alcohol could not possibly be incriminated. In 15 per cent. there was a history of chronic malaria. In 4 of the women, no cause for the cirrhosis could be detected. In 5 per cent. of the total, syphilis may have contributed, although one of the 12 in this group was a habitual drinker. Banti's cirrhosis seems to be anatomically identical with Laennec's cirrhosis; of the 7 cases of this kind, none had a history of abuse of alcohol. Consequently it is incorrect to call Laennec's cirrhosis alcoholic cirrhosis.

Diet. Terol⁸⁷ advises a milk diet in the early stages of cirrhosis of the liver. This leaves the liver comparatively in repose while promoting diuresis. He gives nothing but water the first day, except a purge. An adult should take 3 liters of milk during the day, sipping a small amount every one or two hours. The milk should never be taken more than this at a time as this would distend the stomach, with retention and fermentation, with result injurious for the liver cells, and digestive disturbances which impel the abandoning of the milk diet. (It is scarcely conceivable that 3000 c.c. of milk can be taken in twenty-four hours, if but a small amount (although the exact amount is not stated in the abstract) is sipped every two to three hours.) The milk, the abstract goes on to say, must never be taken raw, but goat's or asses milk may be substituted for cow's milk. (Economic reasons? Certainly in America such substitution would be difficult to practice.) Fermented milk or condensed milk, etc., should not be used except when the patient wearies of the sterilized milk. This milk diet should be kept up for a month. After this the ordinary diet can be very slowly and gradually resumed keeping to small meals of easily digestible foods. He advises four meals, the latest two being at 5 and 9 P.M., but they should not be abundant. Weak mineral waters are useful, avoiding all carbonated beverages as their gas distends the stomach. Mastication should be especially thorough, and the patient should give both body and mind a rest after eating. General and tonic hygiene should be enforced. In cirrhosis with hypertrophy, there is excessive functioning on the part of the liver, and the diet should aim to reduce production of toxins, being restricted to starchy foods and dry vegetables with little

⁸⁵ Journal of the American Medical Association, 1918, lxxi, 2127.

⁸⁶ Abstract, Journal of the American Medical Association, 1919, lxxii, 905.

⁸⁷ Ibid., 1918, lxxi, 1447.

sugar or substances liable to putrefy. In cirrhosis with atrophy, meat should be positively prohibited to ward off production of toxins, and salt should be restricted to 6 gm. a day to guard against ascites and edema.

My knowledge, or rather lack of knowledge, of Spanish prevents me from reading this article in the original, and does not authorize me to criticize any too authoritatively Terol's paper. I cannot see, however, that the dietetic treatment recommended by him has any advantage over the neglected, and little-known, Karell diet. In fact, the recommendation to give 3000 c.c. of fluid seems inadvisable even in the early stages. Terol does not speak of ascites, which, of course, is the indication for the Karell diet, so presumably he recognizes and treats cases long before this symptom appears.

Hepatitis of Amebic Origin. Ravant and Charpin,⁸⁸ who have written extensively on amebiasis since the beginning of the war, call attention in this latest paper to certain paradoxical things which lead the diagnosis astray more often than is generally supposed. Their first dictum is that a patient may have amebæ in his liver which may be demonstrated by puncture even if he has no previous history of dysentery, if he has not been in the tropics, if he has had no fever and if his stools, which may appear normal, contain no cysts or amebæ. This being true, they recommend that the presence of amebæ be suspected when a patient has a sharply defined painful spot in the course of a hepatitis. The epigram of Manson is recalled, "The great success of a happy diagnosis of a hepatic abscess is to suspect it." Two different methods for recognizing hepatic amebiasis are at the disposal of the physician—the first is the direct method or puncture, the other is the indirect, or therapeutic test.

Exploratory puncture is most valuable as, apart from the diagnosis, the examination of the pus indicates whether the treatment shall be surgical or medical. But, unfortunately, exploratory puncture may be entirely negative, either because the abscess is not tapped, or because pus has not already formed, or because the case is one of simple hepatitis without suppuration. Under these circumstances, medical treatment is followed by such rapid improvement that it is a veritable touchstone. Emetine and, better still, a mixed emetine and arsenic treatment has been most successful.

The writers give 10 intravenous injections of neoarsenobenzol not exceeding the dosage of 30 cgm. one every six days. Between the first four injections, emetine is given for three consecutive days in doses of 4, 6, or 8 cgm. These are discontinued between the fourth and seventh injection of neoarsenobenzol, and resumed after the seventh as before. In forty days the patient received 10 arsenical injections, and 18 of emetine. (Their calculation seems wrong to the reviewer as 10 injections every six days cannot be given in forty days.) This therapeutic test is so striking in its results that Ravant and Charpin say it should be employed in cases of illy defined hepatitis even if all the usual signs

⁸⁸ Presse méd., February 10, 1919, p. 65.

of amebiasis are absent. Two temperature charts showing defervescence, with their treatment, illustrate their paper.

Function of the Gall-bladder. There is an article by Mann⁸⁹ on this important subject, and after its first perusal which seemed to justify abstracting it, an abstract was begun, completed and destroyed, for the reviewer found that although Mann had made some very interesting studies in comparative anatomy and had evidently derived much pleasure and profit therefrom, he advances the subject not a bit. He quotes extensively from previous writers, and the bibliography is fairly full, and he describes adequately the action, anatomy and comparative anatomy of the gall-bladder, but, as he says, "A description of the action of the gall-bladder does not explain its function." Therefore our abstract was pointless, and we refer the reader to Mann's article for a long article on "The Function of the Gall-bladder—An Experimental Study," a title which seems to us a bit pretentious and a bit misleading.

Influence of Internal Secretions on the Formation of Bile.⁹⁰ Using dogs and counting the drops of bile that fell from a cannula in twenty minutes, the authors after injection of commercial gland substances, found the following: Adrenalin, mammary, orchitic, ovarian, pancreatic, and thymic gland substances decreased the secretion of bile. Secretin increased it, while spleen and thyroid gland were without effect.

Increased by
Secretin.

Decreased by
Adrenalin.
Mammary.
Orchitic.
Ovarian.
Pancreatic.
Thymic.

Unaffected by
Spleen.
Thyroid gland.

Metabolism of Bile Acids. Bile acids have been made the subject of a series of papers by Foster, Hooper and Whipple.⁹¹ In a footnote the following appears: "This series of papers on Bile Acid Metabolism was completed just prior to the death of Miss Foster from influenzal pneumonia. The work should stand as a memorial to her enthusiasm, patience and spirit of truthful research. This work was submitted as a thesis for her degree of Doctor of Philosophy, University of California." The research is indeed a noteworthy one and it is to be regretted that Miss Foster could not have had her coveted degree which the work presented certainly warranted.

The papers are particularly interesting to the present reviewer because of some similar work which he presented over a decade ago. Not only because some of the authors' conclusions are the same as his, but because of the reviewer's appreciation of the vast amount of labor the research has demanded. In addition, it is gratifying to see this concrete example of American scientific advance, and to realize that no longer is it necessary to rush to Continental schools and laboratories for inspiration and facilities as was the case fifteen or twenty years ago.

⁸⁹ New Orleans Medical and Surgical Journal, 1918, lxxi, 80.

⁹⁰ Downs and Eddy: American Journal of Physiology, March 1, 1919, p. 192.

⁹¹ Journal of Biological Chemistry, 1919, xxxviii, 355.

The first of their series of six papers deals with the technic for the determination of bile acids, a painstaking study of previous methods with the resultant exposition of an original procedure based on the determination of amino nitrogen in taurine with the Van Slyke amino-nitrogen apparatus. The method is much simpler and apparently more accurate than are the older methods, and results can be obtained within eight hours. That the bile is subject to normal fluctuations is true, and the authors found that although the amount of bile acid excreted hourly during any given day is fairly uniform, yet the amount is usually higher in the morning than in the afternoon, and despite moderate amounts of bile ingested in the late afternoon this variable excretion is not markedly influenced. The ingestion of bile, and particularly of cholic acid apart from any cholagogue action, markedly increases the output of bile acids, a fact long ago demonstrated and now confirmed.

The fourth paper of the series is devoted to the endogenous and exogenous factors concerned in the metabolism of bile acids. An interesting observation has been made that, whereas a high protein diet gives the highest output of bile acids, the same diet is without effect if a long fasting period precedes its administration. The authors seem to believe that owing to depletion of body protein by the fast, precursors of the bile acids are sidetracked to serve in restoring this depletion.

The sixth and final paper of this notable series is devoted to the origin of taurocholic acid. This acid can be readily separated into taurine and cholic acid and it is known that cystin of the food is one of the sources of taurine and probably there are other substances, too, from which it is derived. On the other hand, cholic acid, the authors state, is a substance whose source or usefulness had hitherto defied the investigator. In the reviewer's article of 1907, no guess was hazarded as to its source, and the opinion was expressed that it was a product of the liver-cells following stimulation from one or more sources. It appeared to me certain that no relationship or interdependency existed between cholesterol and cholic acid. This view is shared by Foster, Hooper and Whipple. I must correct the authors in a statement made on page 432 of the number of the *Journal of Biological Chemistry*, in which their admirable work appears, to wit, that "Goodman thought . . . the cholesterol might be the mother substances of cholic acid." It is clearly stated in my original paper that there can be no relationship between cholesterol and cholic acid. It is true that the thought that cholesterol might be the mother substance of cholic acid was considered, but all my experiments definitely and certainly showed that this thought could receive no confirmation from any experimental laboratory investigations. Also I would call attention to the fact that the statement "He used but one dog and that dog lived only four weeks" is inaccurate as the dog was operated upon May 7 and was still being used for experimental studies on the bile at the time of my departure from Strassburg in August, and records of experiments are quoted as far as the end of July.

In view of the hint that by using but one dog my conclusions are

invalid, it is interesting to note that exactly the same deduction as mine concerning cholic acid are arrived at by Hooper and Whipple, and these are, that there is no physiological relationship between cholesterol and cholic acid and that the origin and fate of cholic acid have not been satisfactorily determined.

Cholelithiasis. Three papers by Wilensky and Rothschild⁹² have appeared. The first is devoted to a summarization of our present knowledge of cholesterol metabolism. Amidst the facts culled from the literature stands out prominently the statement that food has an influence on the cholesterol of the bile, a fact long since recognized, and, furthermore, that the increase in blood cholesterol must proceed to a certain stage before an excess appears in the bile.

In the second paper, the relationship of the cholesterolemia to the pathologic process is considered, and from their work, which scientifically is very well done, but which is, unfortunately, far from clear in style, defective in composition, and turbid in exposition, the following has been gleaned. A hypercholesterolemia, although it usually points to some disturbance in cholesterol metabolism and to some disorder of the bile passages is of doubtful diagnostic value. As a diagnostic factor, it can be used on but one occasion, namely, when distinction must be made between jaundice due to cirrhosis of the liver and jaundice due to common duct obstruction. Cirrhosis gives low values, while obstruction gives high.

The third paper is designed to show the immediate effect of the various types of operations upon the cholesterolemia. It is well to recall that the normal content of cholesterol in the blood is between 150 to 180 mg. per 1000 c.c. of blood. The authors recognize the fact that the short period of starvation and active catharsis preceding the operation lessen the cholesterol-content of the body, but inasmuch as these factors are present for such a short period of time, the cholesterolemia is inappreciably affected. The anesthetic itself has little effect upon the blood cholesterol. After all has been said by Wilensky and Rothschild, it is evident that it is immaterial whether cholecystectomy or cholecystostomy is done, provided there is prolonged and complete bile drainage. I would refer the reader to the section on pancreatitis where an article by Archibald on bile drainage in pancreatitis is abstracted. Curiously enough he arrives at the same conclusion, though from a different point of departure.

GALL-STONES AND HYPERCHOLESTEROLEMIA. Fedeli and Torri⁹³ have been conducting research with the mineral waters at Montecatini which are noted for their action in cholelithiasis. The metabolic findings and the course in six cases under the influence of the waters are reported in detail. The cholesterol content of the blood, which was high, sank to normal figures under the influence of the spa treatment. Experimental research confirmed the clinical findings, all testifying that the saline-alkaline waters stimulate the secretion of bile, the less concentrated of

⁹² American Journal of the Medical Sciences, August, September and October, 1918.

⁹³ Abstract, Journal American Medical Association, 1919, lxxii, 688.

the waters being more effectual in this respect as they render the bile more fluid. This in turn helps to wash out the cholesterol, and the blood-content of the blood declines. The general metabolism is modified, in addition, by the waters.

GALL-STONES IN THE TROPICS. In these two articles De Langen⁹⁴ discusses the incidence of cholelithiasis in Java. He was impressed by the rarity of gall-stone cases at the polyclinic and surgical clinic in his charge. He found only one case on the records among the 15,000 patients at the hospital and this was not a native of the East Indies, while not a single case was seen among the 40,000 outpatients. The figures from Semarang are 8 cases in 47,000. In 1914, throughout the whole of Java, 3 cases of gall-stones were recorded among the 58,021 hospital and outpatients. There have been only 30 cases of gall-stones diagnosed in the last ten years in the government infirmaries among the 422,943 admittances.

The cholesterol-content of the blood of natives is exceptionally low. This fact suggests a causal connection and disproves the theory that infection or stagnation is the prime factor in cholelithiasis. This assumption is the more plausible as the natives of the East Indies are subject to infections of the liver and biliary passages, and pregnancies there do not differ from pregnancies in other countries where gall-stones are common. The few gall-stones found in Java are usually of the rare pigmented type, such as is found with hemolytic jaundice. Only from 3 to 11.2 per cent. cholesterol was found in gall-stones found in 15 cadavers, and in only one of the cases had cholelithiasis been suspected during life.

Pruritus seems also to be exceptionally rare among the natives, which, in turn, may be explained by the low cholesterol-content of the blood. Diabetes and chronic nephritis, with which hypercholesterolemia is often associated, are likewise rare in Java. De Langen recalls that beriberi is a disease locating in the nervous system—which is the most lipid-rich tissue in the body—and hence study of beriberi may yet reveal that the vague notion of vitamins will merge into the problem of liquid metabolism. Certain data he has accumulated sustain this hypothesis, and it is attractive further from a therapeutic point of view. "*Chercher la physiologie c'est éclairer la pathologie.*" The *Journal* calls attention to the fact that this article is in parallel columns of Dutch and English, but it has not been my privilege to see the original paper.

TREATMENT OF CHOLELITHIASIS. Although this paper, judging from the title, refers particularly to the treatment of cholelithiasis, it must be noted that Hemmeter⁹⁵ has spared no pains to review the subject of gall-stones in a comprehensive manner. The relative frequency of stones, their etiology and the diagnosis of the same are discussed in a way which will be profitable to the reader but which the reviewer thinks

⁹⁴ Abstract, Journal of the American Medical Association, 1918, lxxi, 1099; 1919, lxxii, 767.

⁹⁵ Medical Record, October 5, 1918, p. 575.

best not to abstract. In treating cholelithiasis, Hemmeter, believing in the bacteriological factor in the etiology, says the first step in treatment is to discover the bacteriological cause, and, this being determined, the next step which logically follows is to have a serum prepared. The organism is obtained by duodenal intubation.

In planning any treatment, however, the following four conditions must be borne in mind:

(1) The gall-stone colic with the acute occlusion of the common gall duct and the recurrent cholelithiasis.

(2) Inflammation of the biliary vessel and reservoir system (gall-bladder, cystic duct), the acute cholelithic cholecystitis, with its consequences: (a) perforation peritonitis, (b) diffuse cholangitis, (c) chronic cholecystitis, with empyema and dilatation of the gall-bladder.

(3) The invasion of the deeper bile passages by the stones, chronic occlusion of the gall-duct. The differential diagnosis and management of the various types of icterus.

(4) The consequences and complications of cholelithiasis and malignant neoplasm of the gall-bladder.

Medical treatment has for its object the bringing about of a period of quiescent latency in the disease. Since only 5 per cent. of gall-stone carriers have symptoms (Hemmeter) operative treatment seems not to be indicated in every case. Hemmeter recommends cholagogues. They act in no way as solvents, but they merely increase the flow of bile and hence the biliary passages are washed out. According to Hemmeter, oil is an inefficient medicament to use. Nothing specific is given by Hemmeter, the ideas about treatment being general in character and apt to be of no benefit to those who seek concrete facts.

Should the reader desire prescriptions and formulæ, he is referred to the article by Niles in the *Southern Medical Journal*, January, 1919, p. 10.

OPERATIVE INDICATIONS WITH GALL-STONES. In Ribas'⁹⁶ 116 operative cases of gall-stones, fully 50 per cent. never had actual gall-stone colic. The diagnosis in many cases was based merely on vague, indefinite sensations, but starting in the subhepatic region. The gall-stone itself, as a simple foreign body, never interests the surgeon, merely the consequences from its presence. The clinician likewise is not interested in the expulsion of the stone, but in the condition left afterward. If the gall-stone proves to be round and composed of cholesterol, this is an aseptic concretion, and may be assumed to have done little, if any, damage. The discovery of diverticuli in the walls of the gall-bladder has confirmed the general assumption that infection once installed is difficult to dislodge—an additional reason for cholecystectomy. This removes the organ which is the source of gall-stone production, while the infection responsible for the development of the gall-stones has rendered it functionally useless. The horse, the ass, and certain other animals have no gall-bladder, and experimental research and the clinic confirm that this organ is not necessary to life. In his 27 cases of simple chole-

⁹⁶ Abstract, Journal of the American Medical Association, 1919, lxxii, 1502.

cystectomy, one patient with a hydatid cyst in the liver succumbed to pneumonia; the others all recovered; 13 died in the 70 cases with drainage of the hepatic duct. In 10 of these cases the progressive course of the surrounding inflammatory process was responsible for the fatal outcome.

Ribas' experience teaches also that, as a rule, the danger is greater with an extremely acute cholecystitis developing for the first time than with an equally acute flaring up of a chronic cholecystitis. With the latter, the walls are thicker and there is less danger of perforation. The form with typhoid is distinguished by the rapid enlargement of the gall-bladder accompanied by high fever and local pain. All this may regress spontaneously, but if the toxic action is pronounced and it keeps up for several days, in typhoid or paratyphoid, he advises cholecystectomy. He does not approve of palliative operations except for certain rare indications. He gives an illustration of a case in which acute cholecystitis during convalescence from paratyphoid developed fatal perforation under expectant treatment, and describes 17 different types of chronic gall-bladder disease, illustrating specimens, with two colored plates. In one case the liver was completely wrapped around the gall-bladder as far as the cystic duct, and adherent.

He has operated in 10 cases of subphrenic abscess traceable to gall-stones. There is generally a secondary pleuritic effusion just above in such cases, and this may mislead the diagnosis. In one case puncture was negative until the needle was inserted in the posterior axillary line between the fifth and sixth ribs, which opened up a large extraperitoneal abscess between the diaphragm and the rear of the convex surface of the liver. A complete cure was not realized, however, until the gall-bladder was removed five months later. There were evidences of pancreatitis in 42 of Ribas' 116 cases, and there was a history of gall-stones in 5 of his 12 operative cases of hemorrhagic pancreatitis. He regards cholecystectomy as the surest means to cure pancreas mischief with gall-stones. He has had 3 cases of cancer of the gall-bladder and a stone was found in this organ in one of them.

CHOLECYSTECTOMY versus CHOLECYSTOSTOMY. Cardenal⁹⁷ admits that cholecystectomy is indicated when the gall-bladder is inflamed from the presence of stones and the common duct is free from obstruction. When the common or hepatic duct is obstructed and this cannot be corrected at once, he advises against cholecystectomy. When the obstruction seems to be permanent, as with cicatricial stenosis, he advises at once an anastomosis between the gall-bladder and the stomach or duodenum. Otherwise he advocates deep cholecystostomy, suturing the gall-bladder, not to the skin, but to the peritoneum. In several cases he has made an opening between the gall-bladder and the stomach, and the functional results have been perfect. There was never any disturbance from this emptying of the bile into the stomach. In one case of cancer of the pancreas, the patient improved remarkably after this operation, and there were no further disturbances from the biliary apparatus.

⁹⁷ Abstract, Journal of the American Medical Association, 1918, lxxi, 1524.

DIFFERENTIATION BETWEEN OBSTRUCTION FROM GALL-STONES AND CANCER. Giacobini⁹⁸ has often found it difficult to distinguish between the symptoms caused by cancer of the head of the pancreas and by obstruction of the common bile duct by gall-stones. The symptoms are practically identical in each, he says, but the urine findings may throw some light on the true condition. With cholelithiasis and with pancreatitis inducing stenosis, he found uric acid abundant in the urine with both, but there was steatorrhea, besides, with the latter. With a calculus in the duct of Wirsung there is both uric acid in excess and steatorrhea, but no jaundice. With a gall-stone impacted at the ampulla of Vater, there were always all three, uric acid in excess, steatorrhea and jaundice. On the other hand, with cancer of the head of the pancreas, the uric-acid content of the urine keeps within normal range until finally it becomes subnormal, while with gall-stone trouble it was always above normal.

Pericholecystitis. Smithies⁹⁹ has the habit, when he presents a paper, of giving so much information based on careful statistical analysis, that in making a review of his work I find myself confronted with the desire on the one hand, to give his article verbatim, which of course, is the simplest course to pursue, and on the other hand I am brought face to face with the realization that I cannot do Smithies justice in an abstract. No other writer gives me so much concern, although each year I realize that this anxiety must again be my portion as it has been in the past.

He has analyzed 424 cases, and the first part of his paper is devoted to a full discussion of the anatomical and pathological changes in the gall-bladder and in contiguous or adjacent structures. This side of the subject can be neglected in this review, as the section devoted to the clinical manifestations of pericholecystitic adhesion has perhaps the greater interest for those who read these pages.

Of the 424 cases, 18 had no symptoms pointing to abnormality of the gall-bladder or digestive apparatus; 21 showed malignancy, and the remaining 385 were those cases in which there was evidence before operation of a sufficient departure from normal to warrant exploration of the right upper abdominal quadrant. Adhesions cannot be differentiated from dyspeptic disturbances referable to gall-bladder trouble without adhesions unless there is evidence of gross abnormality of function in neighboring viscera coexistent with the gall-bladder upset. This disturbance is commonly mechanical in nature.

Pain is of little assistance in the diagnosis between gall-stones and adhesions, and the behavior of the bowels is likewise unnoteworthy in this connection. Nausea is scarcely a distinctive feature. Jaundice seems to be rather more frequently seen in cases of stone than in those individuals with obstructions due to adhesions.

Gastric function was interfered with in only 7.1 per cent. of the cases, and the emptying power was affected (twelve-hour retention). As opposed to non-gall-bladder conditions, notably gastric cancer, duodenal

⁹⁸ Journal of the American Medical Association, 1918, lxxi, 1804.

⁹⁹ *Ibid.*, lxxi, 321.

ulcer and gastric ulcer, where twelve-hour retention was observed in 7.1 per cent., 52 per cent., and 39 per cent., respectively, the absence of retention in cases of disease in the vicinity of the right upper abdominal quadrant, is rather significant. Apart from a rather high proportion of achlorhydria, gastric secretion is little affected. High acidities are encountered in numerous cases, quite as high as are found in ulcer, but there is no blood. This to Smithies seems important, as he apparently is accustomed to finding blood in peptic ulcer. No one will deny that in fresh ulcer this is true, although there no test-meal is required to assist in establishing the diagnosis, but there is room for debate as to whether old peptic ulcers show blood in a test-meal.

Roentgen Ray Evidence. By means of plates it is scarcely possible to differentiate gall-bladder adhesions from anomalies due to chronic ulcer of duodenum or pylorus. If, on the other hand, the pictures show enlarged gall-bladder, definite gall-bladder contour or stone shadows, then in the absence of clinical data indicating organic disease of the stomach or duodenum, gross anomalies of these viscera may with a fair degree of safety be interpreted as being due to pericholecystitic adhesions. The fluoroscope is of greater value than plates, and antispasmodic drugs should be used if mistakes are to be avoided.

To give the impression made upon the reviewer by Smithies' paper, it will suffice to say that the diagnosis of pericholecystitis seems to be a very difficult one, and nothing that Smithies offers makes the diagnosis less troublesome. It suffices here, as in many another abdominal disease, to recognize that there is an infirmity within the abdomen, for which surgical treatment is indicated.

After writing the above, an article by Churchman¹⁰⁰ came to my notice containing the following paragraph with which he concludes his paper: "I do not think it can be said that the clinical symptoms associated with adhesive pericholecystitis are characteristic enough to make us sure of a diagnosis of adhesions about the gall-bladder. The study of these cases does not reveal any characteristic symptom or syndrome, but it becomes increasingly evident that symptoms referable to the right upper quadrant should, in all cases in which positive diagnosis cannot be established, lead to an exploration; for, aside from the well-known fact that both cholelithiasis and gastric ulcer may be overlooked if routine explorations of this kind are not made, it is also true that cases of the sort here reported, which in their milder form might well be classed as gastric neurasthenia, would go unrelieved unless explored and the adherent gall-bladder excised. No results could be more gratifying than the complete relief afforded to these wretched patients."

Cholecystitis. The following table from Bodenstab's¹⁰¹ analysis of 500 cases of cholecystitis, some with, and some without, stones is reproduced for reference, as the symptomatology shown therein is fully discussed.

¹⁰⁰ Journal of the American Medical Association, 1919, lxxi, 17.

¹⁰¹ Ibid., 1918, lxxi, 12.

SYMPTOMS IN FIVE HUNDRED CASES OF CHOLECYSTITIS.

	Cholelithiasis, 340 cases.		Cholecystitis, 160 cases.	
	No.	Per cent.	No.	Per cent.
Tenderness	292	86.0	150	94.0
Belching	271	79.7	107	67.0
Vomiting	269	79.1	76	47.5
Cramps, radiating	244	71.8	61	38.1
Dyspnea	243	71.8	63	39.4
Epigastric distress	117	34.4	72	45.0
Prostration	96	28.2	7	4.4
History of jaundice	79	23.2	13	8.2
Cramps, not radiating . . .	69	20.3	84	52.5
Bile in urine	59	17.3	3	2.0
Sex	M. 36, F. 304		M. 40, F. 120.	
Parity	0 to 15, average 6		Average 5.	
Gastric acidity	0 to 100; average: free, 24; combined, 18		Average: free, 35; combined, 17.	
Duration of illness	1 month to 26 years		1 month to 37 years.	
Time of day	Day, 2 per cent.; night, 10 per cent.; day and night, 88 per cent.		Night, 6 per cent.; day and night, 94 per cent.	

Tenderness. This is the most constant symptom; its degree depending on the severity of the inflammation and the degree of distention of the gall-bladder. Bodensstab recommends the following manner of eliciting this symptom: "The examiner places his left hand firmly, with the palm up, in the patient's right flank, and the tips of the fingers of the right hand below the right costal arch over the region of the gall-bladder. The patient is then asked to breathe deeply. On exploration, when the abdominal muscles are relaxed, a sudden pressure upward with the right hand is made. If the gall-bladder is distended, a sharp sting is experienced by the patient, which manifests itself by a typical expiratory 'catch' or 'grunt.'"

Belching. The author believes that there is a difference in the belching occurring in ulcer and in cholecystitis. In the latter, it occurs independently of meals, often being most pronounced between meals, coming on suddenly, lasting but a short time, and being followed by prompt relief from the upward pressure. In ulcer, on the other hand, it usually occurs at a specified time after meals and disappears when gastric digestion is completed.

Vomiting. The vomitus nearly always contains bile. Sometimes the vomiting will relieve the attack, as is the case in gastric ulcer, but often the patient keeps on vomiting until the bile ceases to flow into the stomach.

Radiating Cramps. Due to distention of the gall-bladder from obstruction of the cystic or common duct, severe epigastric pain is experienced, with radiation either to the right costal arch or to the left, and through to the back or the region of the shoulder blade, or to the right or left shoulder, which, after a longer or shorter terrific spell, ceases as suddenly as it appeared. Of a sharp, lancinating character it comes on either day or night at irregular intervals, often bearing no relation to food and without any apparent cause. In cholelithiasis the attacks of colic are more severe, with a return to health when they

cease, while in cholecystitis the attacks are less severe, of longer duration, with a succeeding soreness which may last several days.

Dyspnea. There is pain during an attack of colic which is sharp and stabbing, and, being made worse on deep inspiration, leads to breathlessness and is therefore often mistaken for pleurisy or pneumonia.

Epigastric Distress. The reflex stomach symptoms often cause far more annoyance than the local trouble itself. The symptoms vary in degree, all foods causing distress, uninfluenced by soda or acid, but usually relieved by belching or vomiting. The symptoms, therefore, are so much like those of gastric ulcer that a differentiation requires much care.

Prostration. During an attack of gall-bladder colic, prostration and anxiety may be so severe as to lead to the feeling on the part of the patient that he is about to die. This symptom is present much more frequently in stones than in cholecystitis without stones. Bodenshtab lays much emphasis on this fear of impending death, as is the habit of many of us in angina pectoris.

Jaundice. Radiating pains in the epigastrium with jaundice make the diagnosis certain.

Cramps not Radiating. Referring to the appended table it will be seen that in 20.3 per cent. of the stone cases there was a history of epigastric pain that was not radiating while in 52.5 per cent. of the cholecystitis cases without stones there were cramps in the epigastrium that did not radiate. Therefore, non-radiating cramps accompanied by other gall-bladder symptoms favor the diagnosis of cholecystitis rather than of cholelithiasis. The cramps are real, lancinating, severe pains and are not to be confused with simple epigastric distress.

Bile in the Urine. Bodenshtab believes 80 per cent. of gall-stone cases have bile in the urine within the first twenty-four hours after an attack.

Regarding the other symptoms given in the table there is little in Bodenshtab's elaboration of the same that is of particular note. The table speaks for itself. He regards the x-ray as of doubtful aid, despite the fact that able men such as Case, Pfahler and George are enthusiastic about the possibilities of this form of examination (50 to 85 per cent. diagnoses). The duodenal tube has been used but he finds it of no particular value, infected bile and mucus being found in apparently normal cases and sterile bile in patients who at operation showed gall-stones.

Bodenshtab places the most diagnostic reliance on the older methods of examination, particular emphasis being laid on history, as in 90 per cent. a correct diagnosis can be made from the history alone, and in 95 per cent. of these cases the diagnosis is an established fact when the five cardinal symptoms are present, namely: radiating pains, vomiting, belching, dyspnea, prostration.

A study of all the gall-bladders removed at the Mayo clinic from the standpoint of bacteriology has been made by Brown.¹⁰² He found that streptococci are the chief microorganisms associated with cholecystitis.

¹⁰² Archives of Internal Medicine, 1919, xxiii, 185.

The numbers are proportionate to the degree of gross and microscopic changes. The elective affinity for the gall-bladder of animals from the strains from the tonsils indicates that cholecystitis is commonly a blood-borne infection from a focal source.

DISEASES OF THE PANCREAS.

Acute Pancreatitis. Although this condition is essentially a surgical disease, and as such will be considered in the proper place by another contributor to PROGRESSIVE MEDICINE, it is a disease, with the diagnosis of which it behooves the internist to be familiar, since, as Deaver¹⁰³ says, it is more often unrecognized than it is diagnosed before operation. There is no one sign which is pathognomonic of the disease, which occurs but infrequently, but as is so often the case in abdominal conditions it is sufficient to recognize that operation is imperative without waiting for a positive diagnosis.

Pain, which is invariably present, is nevertheless variable in its location, originating in various parts of the abdomen, although, as a rule, it starts deep in the epigastrium rather to the left, radiating to the back and is overwhelmingly severe. It is more agonizing than that of a ruptured viscus and is accompanied by such an extreme degree of shock that death ensues in a few hours. The pain may be mistaken for an acute obstruction but here the pain is less severe at the onset, growing intermittently worse as the case progresses. The *pointe pancreatique* of Desjardin, 5 to 7 cm. above a line connecting the umbilicus with the right axillary cavity (this being approximately over the outlet of the Duct of Wirsung) is, according to Deaver, of less value as a diagnostic sign than is Mayo-Robson's point, about 10 cm. above the umbilicus. Sometimes the pain localizes itself in the appendiceal region, and in some cases a tumor mass may be felt in the ileocecal area.

Vomiting is a constant feature and is frequent and persistent for twenty-four hours when it may subside. It is not fecal except in the late stage. Nausea and retching may continue, hiccough is a frequent symptom and is persistent and oft repeated. There is absence of marked rigidity, which is such a pronounced feature of ruptured viscera. Deaver emphasizes tenderness in the left costovertebral angle as indicating involvement of the body of the pancreas, but more especially the tail. Distention is not so marked as in other abdominal crises and at first is limited to the upper portion of the abdomen. In some instances distention is absent.

The pulse, usually quiet and slow at first, gradually increases in rate. At first the temperature is subnormal following the initial collapse and rises moderately later on, but the temperature range is low compared to that of a spreading peritonitis. Cyanosis is frequently seen and seems to have a rather characteristic dull yellow hue. Leukocytosis of the polynuclear variety is seen.

¹⁰³ Annals of Surgery, 1918, lxviii, 281.

Deaver writes "We may therefore say that a sudden acute abdominal seizure, pain overwhelming in an apparently healthy, usually obese, individual, accompanied by incessant vomiting, upper abdominal distention, a transverse resistance not easily elicited, a weak pulse, subnormal temperature, collapse and sometimes cyanosis, should suggest pancreatitis. The previous history will usually reveal one or more, usually more, attacks of severe epigastric pain which have been regarded as gall-stone colic and have been treated as such. Not infrequently the first attack of this kind occurs during or soon after pregnancy." In view of the fact that in gall-stone disease the pancreas may be frequently affected and in view of the unfavorable prognosis in acute pancreatitis, Deaver justly recommends early surgery for cholelithiasis.

Pancreatic Lymphangitis. The well-known observation of Deaver that the first stage of chronic pancreatitis is nearly always disease of the pancreatic lymph glands, is again discussed by him in a short article in *Surgery, Gynecology and Obstetrics*, May, 1919, p. 433. This primary disorder is rarely diagnosed before operation, nor is it always possible to make a pre-operative diagnosis of pancreatitis itself. Confusion arises because of the similarity of the symptomatology of other upper abdominal disease. Jaundice in the absence of definite reasons for jaundice suggests pancreatitis, the jaundice being more gradual than in gall-stones, with greater intensity.

Effect of Bile Drainage in the Cure of Pancreatitis. As Archibald¹⁰⁴ points out, the diagnosis of pancreatitis is rather loosely made on the operative findings of a swelling of the pancreas in such patients as recover. The test of the treatment is also rather casual, namely, recurrence or absence of symptoms similar to those for which the operation was performed. The criterion of palpatory findings at operation is recognized by Archibald as very dependent on the personal equation of the operator, but, in the hands of well-known, skilful operators, this error may perhaps be not so great as at first supposed. If an operation is undertaken for gall-stones, which may or may not be found, the pancreas is variably thickened and hardened. If gall-stones are present, these are removed, drainage is instituted and the surgeon believes the pancreatitis will take care of itself. Should gall-stones not be found, cholecystostomy is performed just the same.

The other criterion of improvement after operation, namely subjective symptoms, Archibald recognizes may be open to the criticism, that in the patients with gall-stones one cannot be certain that the recurrence or persistence of symptoms may not be due to recurrence of gall-stones or to cholecystitis. He assumes that when the operation is properly conducted, gall-stones rarely recur, and he regards all later symptoms suggestive of those of the pre-operative treatment as being due to pancreatitis. Of 15 cases, only 3 were cured, 7 had persistent trouble, and 5 were merely improved. These 15 cases had a tube in the gall-bladder for two weeks or less. Four cases had a tube for more than two weeks but not more than three weeks. Three are cured and 1 still

¹⁰⁴ Journal of the American Medical Association, 1918, lxxi, 798.

has trouble. Five cases had a tube in the gall-bladder longer than three weeks and all of these say they are cured.

Although these cases are few in number and although there was no re-laparotomy, to furnish exact anatomical information, Archibald feels that he can deduce the following fact: that the shorter the period of drainage the more likely are the symptoms to persist, and that when the drainage is continued for four weeks or more, cure is more probable. He recommends, therefore, longer drainage. The rationale of the cure depends not so much upon the principle of draining infected bile as it is the reduction and prevention of rises of pressure in the biliary system. There is a sphincter-like action of the outlet of the common duct as described by Oddi, and it is not unlikely that spasm readily takes place, with a rise of pressure in the bile tract which forces bile into the pancreas and so sets up a pancreatitis. Cholecystectomy, although recommended by the Mayo clinic, is not necessary, according to Archibald. For discussion of this point the reader is referred to the article under review, as it is feared too much space has been already devoted to a surgical subject, not wholly without interest, however, to the internist.

Pancreatic Infantilism. Bullrich¹⁰⁵ reports a typical case of Byrom Bramwell's pancreatic infantilism with the necropsy findings. The case was distinguished further by the patient being a diabetic. Necropsy revealed that the trouble was not in the pancreas so much as in the thyroid and pituitary body. There were lesions in the pancreas, but they were insignificant compared to those in the other named glands. The case was therefore one of pluriglandular derangement. He had been normal and well grown till about the age of eleven years when he began to grow thin, and at sixteen years had pronounced diabetes mellitus. Then came eight months of rebellious diarrhea. At the age of twenty years, he was intelligent but was only about 4 feet tall and weighed only 21 kg. The skin was very dry and wrinkled like that of an old man, and the urine contained from 38 to 45 per thousand sugar. The stools showed signs of pancreas deficiency. Death occurred suddenly in an epilepiform convulsion with nothing to suggest diabetic acidosis.

In the course of my reading, I have found an article by Comby¹⁰⁶ in which this case of Bullrich is given in detail. The reader is referred to this if further information is desired.

Pancreatic Retention. Urrutia¹⁰⁷ reports 2 cases which warn that the absence of pancreatic ferments from the stools does not inevitably mean insufficiency of the pancreas. The outlet may be merely blocked, the amylase thus disappears from the stools and appears in the urine. The pancreas may become insufficient later from the disturbance in the circulation and sclerosis, but even with a cancer in the pancreas, the sound portion of the pancreas may long function perfectly.

¹⁰⁵ Abstract, Journal of the American Medical Association, 1918, lxxi, 1098.

¹⁰⁶ Arch. de méd. des enfants, 1918, xxi, 602.

¹⁰⁷ Abstract, Journal of the American Medical Association, 1918, lxxi, 1783.

DISEASES OF THE KIDNEYS.

BY HENRY A. CHRISTIAN, M.D.

Kidney Function in Disease. In a recent paper, Elwyn¹ has discussed kidney function in relation to the modern theory of kidney excretion and the known facts of kidney pathology. The attempt to correlate our knowledge of the kidney with observed symptoms, function, etc., has been made repeatedly, but certain defects and failures are apparent each time. It is worth while to review this present attempt to see how far we are justified in going at the present time. To do this I will intermingle in the review of Elwyn's paper criticisms based on my own experience for, as it seems to me, he has, in places, made assumptions not quite justified by our present conception of the kidney and its function.

Elwyn starts with a brief statement of what Cushny calls the "modern theory" of urine excretion. Cushny² unquestionably has given us the best recent critical review of kidney physiology. He considers the excretion of urine as the combined result of glomerular filtration and tubular reabsorption. Blood-pressure causes filtration; the glomerular capsule determines the constituents of the filtrate; both together regulate its character. Filtration depends on the difference in pressure on the sides of the membrane, the character of the membrane, and the nature of the filtering fluid. The tubules concentrate the fluid received from the glomerulus so as to preserve water and certain salts for the body economy, the latter Cushny calls "threshold bodies" because they are only excreted when they exceed a certain threshold value in the blood. Substances not absorbed by the tubules limit absorption of water by exerting osmotic pressure. There are no excretory nerves to regulate kidney function.

Elwyn explains the diuretic action of the xanthine compounds by their being non-threshold bodies which, in accordance with Cushny's theory of excretion, would by their osmotic resistance prevent water reabsorption in the tubules and increase the urinary flow. This is not an explanation which Cushny advances in his book nor is it in accord with many observations on patients with renal disease. It is seen frequently that small amounts of a diuretic may cause marked diuresis; here it is not conceivable that sufficient of the diuretic could be present in the tubule to act much by osmotic resistance. Janeway³ has called attention to active diuresis of several days' duration following so small a dose as a single grain of caffein given but once. I⁴ have observed, for example,

¹ Journal of Urology, 1919, iii, 47.

² The Secretion of the Urine, Longmans, Green & Co., London, 1917.

³ Transactions of the Third Congress of American Physicians and Surgeons, 1913, ix, 14.

⁴ Archives of Internal Medicine, 1916, xviii, 606.

very profuse diuresis, 11 liters in twenty-four hours, following three doses of theocin (theophyllin) of 0.5 gm. each. This, I am sure, is a common experience, and one which does not harmonize with Elwyn's explanation.

According to Elwyn, disease can affect kidney function only in so far as it causes damage to a sufficient number of glomeruli or tubules, in the former impeding filtration, in the second diminishing absorption. The primary factor in disease is the function of the glomeruli; when they are damaged so as to impede filtration, another factor is called upon to increase filtration. The only available mechanism for this is to increase the pressure in the filter and the only way this can be done is to increase general arterial pressure, the "compensatory mechanism of hypertension." The kidney is regarded by Elwyn more as a mechanical filter than a secretory organ.

Starting with this assumption, Elwyn reviews various types of renal lesions and explains on a mechanistic basis the changes met with in these various lesions. The explanations have the merit of simplicity but with that goes the defect that too much is assumed to be proved as due to simple mechanical changes, and certain inconsistencies in his explanations crop out. He follows the classification of Volhard and Fahr.⁵ This is an admirable classification considered from a theoretical basis, but practically it is difficult to apply in the clinic as a working classification of individual cases as they come. This criticism, however, does not effect Elwyn's usage of the grouping for his discussion of the subject.

In considering kidney function in nephrosis, or the tubular degeneration of Volhard and Fahr's classification, according to Elwyn, "We must not forget that Bowman's capsule is the beginning of the uriniferous tubule and that the part of the capsule in apposition to the glomerular tuft is just as much involved in tubular lesions as the convoluted tubules, although the glomerular tuft itself is entirely intact and does not show involvement at all." For this statement there seems relatively little basis in observation though on *a priori* ground, however, it may be more tenable. Even here the assumption is made that toxic substances involve all parts of the tubule when actually most experimental work goes to show that toxic substances have a selective affinity for different portions of the tubule, to wit, the tendency of uranium to involve primarily the proximal and spare the distal convoluted portion of the tubule. Furthermore, I am not aware of any descriptions of lesions limited to that part of the glomerulus made up of the invaginated end of the tubule. The nearest approach would seem to be a lesion described by me⁶ in 1908 which may be in this portion of the glomerulus but with which various lesions of other parts of the glomerulus are commonly associated.

However, in the next paragraph, Elwyn leaves this possible lesion of the glomerular tuft entirely out of consideration and states that, as the glomeruli are not involved, filtration proceeds as in normal kidneys. As filtration is normal and absorption possible in high degree, since only

⁵ Die Brightsche Nierenkrankheiten, Springer, Berlin, 1914.

⁶ Boston Medical and Surgical Journal, 1908, clix, 8.

areas of tubules are destroyed, the function of the kidney is hardly disturbed. Even though filtration is not disturbed because the glomeruli are not involved, as already stated, Elwyn does explain that the albumin present in the urine is derived from the blood and passes through the glomerular capsule; a part of it solidifies to form the ground substance of casts. The only way I can harmonize the discrepancy in the above is to assume that glomerular damage is of a nature not to cause any change in filtration but to allow of the escape of the large albuminous molecules. This may be true and explain the presence of albumen in the urine and the simultaneous absence of retention products in the blood, but it hardly seems logical in one paragraph to say the glomeruli are not involved and in the next that the glomerular capsule is injured. The changes are probably not so simple as this mechanical explanation would make them, and furthermore there is much evidence that casts may have another origin than from solidified albumin of glomerular escape.

Edema and cavity hydrops in this type of lesion Elwyn explains, as do most others, by assuming endothelial or capillary injury throughout the body. He then goes on to say: "As the transudates, like all other fluids in the body, contain sodium chloride in the same proportion as the blood, the sodium chloride in the urine is therefore reduced." Here again a very simple explanation is offered for a process which has aroused much speculation as to its cause. Of course the accumulation in body fluids is a factor but most probably not the only and possibly not the chief factor. Certain it is that in patients, in whom edema remains stationary, there may be almost no sodium chloride excretion and types of nephritis are recognized with low salt content in the urine and no edema. So salt poverty in the urine seems to occur without any necessary causal relation to accumulation of body fluid.

The sublimate kidney is a subform of tubular degenerative disease, when severe, a necrotic nephrosis. According to Elwyn, "glomeruli are not involved . . . unless complicated by reflex constriction of the kidney vessels resulting in anuria." Compensatory hypertension seeks to force blood into the glomeruli. "If this does not succeed, the rest nitrogen level in the blood gradually rises." As ordinarily reported, rise in blood nitrogen occurs very early in sublimate poisoning and blood-pressure often remains only a little elevated. In some cases, however, blood-pressure is elevated later, especially, according to Volhard and Fahr, when anuria has persisted.

In acute focal glomerulonephritis, hematuria is the only finding explained. "Hematuria in Bright's disease always means glomerular inflammation with lesion of the part of the capsule just over the inflamed glomeruli. This allows the red blood corpuscles to get through with the blood plasma practically unfiltered." The glomerulus is a frequent source of blood but this explanation does not allow for the occurrence of hemorrhage between the tubules of the kidney with escape of blood into the lumen of the tubules, often seen in sections of kidneys with Bright's disease, nor for the hematuria of chronic interstitial nephritis where the source is in the renal pelvis or the calyx of the kidney in which dilated veins have been observed to be ruptured.

In the first stage of diffuse glomerulonephritis, according to Elwyn, "tubular degeneration will, of course, show itself by the presence of marked albuminuria." This explanation is in contrast to the glomerular origin already assigned to albuminuria in tubular degenerative lesions. Under a description of the end stage of this type, uremic symptoms are explained "by the concentration in the blood of non-protein nitrogenous substances, chief of which is urea, . . . and of the ordinary acid products of metabolism," an explanation which is simple enough but one that has not been accepted by many investigators of nephritis.

Benign hypertension is explained on the basis of vascular narrowing in the kidney impeding blood flow to the glomeruli, and, to maintain renal function, general vascular hypertension results. This explanation is not in accord with my study of the group of benign hypertension cases. To me, it has seemed that renal change was merely a part of general vascular disturbance, or very often renal changes were purely secondary to the general vascular lesion. In this group nycturia is attributed to a latent edema in which the retained fluid is eliminated at night. My own studies of this group indicate that delayed excretion is an expression of overwork or fatigue; moreover, edema may be absent for years in this group which is hard to harmonize with the idea of latent edema. Nocturnal attacks of asthma are thought due to beginning pulmonary edema; again, this hardly seems a plausible explanation.

It would be very satisfactory were it possible to explain the changes in nephritis on a mechanical basis with blood-pressure increases directly compensatory in the effort to increase filtration as Elwyn does, but, unfortunately, there are many observed facts, as we study our patients, impossible to harmonize with these explanations even when the explanation seems to meet the requirements of most cases. The fact remains that kidney structure and kidney function are very complex; much about them is not thoroughly understood; in disease, relations probably become more complex, at least the function of the diseased kidney is less well understood.

Studies of Non-protein Nitrogenous Substances of the Blood. Larkin and Levy⁷ point out that the failure to thoroughly understand the cause of nitrogen retention has led to both an under-estimate and an over-estimate of its importance in kidney lesions, and that to understand the cause of nitrogen retention, due consideration must be given to extra-renal factors that influence it. Most important of these, is (1) diet; (2) certain little understood metabolic conditions; (3) an increase in the nitrogen content of the blood in cases of edema when marked diuresis takes place with a rapid return of the nitrogen to its former level after the elimination of the fluid; (4) a definite rise in the nitrogenous elements of the blood shortly before death (from twenty-four to forty-eight hours) irrespective of the type of the kidney lesion. These extra-renal factors the authors enumerate but do not discuss.

They follow the classification of Volhard and Fahr in their discussion of blood findings associated with different types of renal lesions, and

⁷ International Clinics, 1918, 28th series, ii, 26.

point out that in the acute glomerular lesions the blood nitrogen is normal unless there is marked oliguria or anuria, when there then takes place an increase. Of particular interest in the cases of acute glomerular lesions are the convulsive seizures which the authors term "eclamptic uremia," though there is no association with pregnancy; in fact, in the few cases which they describe, the convulsions occurred in the male. In these so-called eclamptic convulsive seizures or eclamptic uremia the blood-nitrogen, at the time and subsequently, remains normal. In contrast to this, when similar attacks occur in chronic glomerular cases, the blood-nitrogen is increased. On this account, whether or not it is increased becomes of considerable prognostic import. In the chronic glomerular lesions the blood-nitrogen is usually increased, though in one case coming to autopsy and showing both intra- and extracapillary glomerular changes, the blood-nitrogen was normal. In these chronic cases an increasing nitrogen-content of the blood is a bad prognostic sign.

In the arteriosclerotic type of kidney, the glomeruli and parenchyma of the kidney are secondarily involved, with the end-result of so-called primary contracted kidney. These patients do not die of their kidney lesion but of the accompanying arteriosclerosis, cardiac failure, apoplexy or intercurrent infection. It is exceptional for them to present uremic symptoms, and during the course of the disease the blood-nitrogen usually gives normal readings, but markedly increases shortly before death. When the arterial changes are marked, this increase has been observed ten to fifteen days before death and probably occurs much earlier.

In the tubular type, the so-called nephrotic kidney, according to these authors, clinical symptoms are due to extra-renal causes; glomerular changes are rare. The blood-nitrogen in this type is within normal limits. These cases rarely come to the autopsy table for it is a lesion which usually goes on the repair.

As pointed out by Kast and Wardell,⁸ there still remains some confusion as to what should be considered the normal, and what a pathological, urea-content of the blood. Whereas some have reported quite wide ranges of normal values, other observers are not thoroughly convinced of the correctness of these values, and the majority of investigators have found that the concentration of urea nitrogen in the blood of normal healthy adults lies between 12 and 15 mgm. per 100 c.c. If these are the correct limits for normal, healthy adults, the question arises as to whether disease, apart from renal disease, causes any change in these figures. Folin⁹ reports that in hospital patients the values are quite as often between 15 and 20 mgm. as below 15 mgm., whereas in strictly normal persons he finds the range for urea-nitrogen in the blood to lie between the quite narrow limits of 14 and 15 mgm.

Kast and Wardell have studied 244 patients in their medical wards. These patients appear to have been taken in rotation and not selected with the view to any particular diagnosis, but those patients who were

⁸ Archives of Internal Medicine, 1918, xxii, 581.

⁹ Journal of the American Medical Association, 1917, lxi, 1209.

unquestionably nephritic were not included. All blood specimens were taken before breakfast, while the patient was still in the fasting condition, in order to eliminate the influence of digestion and absorption. Taking the blood in this way also naturally eliminates moderately delayed excretion as a factor in changing the values because overnight, where there is only a moderately delayed excretion, the figure presumably would have returned to normal by the time the specimens were taken. A urea concentration of not more than 20 mgm. per 100 c.c. of blood was shown in 84 per cent. of the cases; 31 cases showed less than 12 mgm., the lowest figure in this series being 9 mgm.; 99 showed figures between 12 and 15 mgm. per 100 c.c.; 60 between 15 and 18 mgm.; 16 between 18 and 20 mgm.; 23 between 20 and 25 mgm. and 15 between 25 and 35 mgm. In those cases in which the blood-urea-nitrogen was less than 20 mgm., there were no, or very slight, evidences of kidney lesion, but where the figure exceeded 20 mgm. the number and character of other indications of kidney lesion were sufficient to suggest a quite definite impairment of renal function. On the basis of this study, it would seem reasonable to place 20 mgm. per 100 c.c. of blood as the upper limit of the normal value for blood-urea-nitrogen.

Kast and Wardell think that the determination of the blood-urea is quite as satisfactory and far more practical than the determination of the McLean index as a means of estimating the renal excretory power. According to McLean, the index is often below normal when the blood-urea is within normal limits, and in those cases the determination of the index is of considerable value. According to Kast and Wardell, in this type of case a diminution of protein in the diet is followed by a rather slow, but very definite, diminution of urea nitrogen in the blood, whereas in a normal individual the diminution takes place much more rapidly. Consequently, in such cases, successive blood analyses are quite as valuable as the determination of the McLean index.

Myers, and his co-workers, have maintained for some time that determinations of the creatinine content of the blood were of much practical help in the management of the nephritic patient. In a recent paper, Myers and Killian¹⁰ make a further report based on an increased number of individuals studied, in large part patients with advanced chronic interstitial nephritis. These newer studies have not altered their earlier observations, but, by reason of the larger number, carry an increased conviction. As they point out, an increase of creatinine in the blood theoretically should be a safer index of the decrease in the permeability of the kidney than the urea for the reason that the creatinine on a meat-free diet is entirely endogenous in origin. Consequently, a decrease in the diet will lower the urea-content but not the creatinine to any extent. For this reason, urea determinations in the blood form a more sensitive index of response to dietary treatment, creatinine a better indication of prognosis. It seems to me that this is a very important consideration and one fully borne out by a study of the cases that Myers and Killian report.

¹⁰ American Journal of the Medical Sciences, 1919, clvii, 674.

Another very interesting suggestion made by Myers and Killian is that creatinine retention may bear a closer relation to uremia than is the case with urea and uric acid. Creatinine may in the body give rise to the toxic methylguanidine. Koch isolated methylguanidine from the urine of animals dying from parathyroid tetany. More recently, Paton¹¹ demonstrated a marked increase in guanidine and methylguanidine in blood and urine of dogs after removal of the parathyroid and in the urine of children with idiopathic tetany. Foster¹² isolated a very toxic substance from uremic blood in the form of a gold salt, which, when injected, produced symptoms similar to those of uremia. Guanidine forms very characteristic gold salts, a suggestive analogy. Acidosis is recognized to occur in advanced cases of nephritis, and Watanabe¹³ has found a severe acidosis with phosphate retention and calcium decrease in animals after injections of guanidine. All of these observations add plausibility to the suggestion of Myers and Killian and they deserve further investigation in the search for a possible explanation of the very baffling symptom-complex which we speak of as uremia.

In the present paper the authors have collected 100 cases, all showing 5 mgm. or more of blood creatinine. Of the first 73 cases, all have died except one, 60 dying within two months of the observation, and the others within the year, fully justifying the conclusion as to the bad prognostic indication of a blood creatinine of over 5 mgm. This was true notwithstanding the fact that many of the patients were able to be up and about, and some showed considerable clinical improvement. In one patient dietary restrictions reduced urea-nitrogen from 135 mgm. per 100 c.c. to 24 without influencing the creatinine. This patient returned to work as a subway guard and did not die until five months later. An occasional case has outlived the prognostic indication of the creatinine, agreeing with the observations as to the exceptions to the usual prognostic conclusions from tests of renal function discussed on pages 126 and 127.

According to Myers and Killian, urea is a more sensitive indicator of renal impairment and is more useful as a diagnostic test in medical cases and as a preoperative prognostic test in surgical cases while creatinine is a better prognostic sign in advanced nephritis. Phthalein output agrees well with creatinine indications. By reason of the difference in the nature of the tests, the phthalein showing the renal function at the moment, while blood-nitrogen accumulation represents the effect of an accumulating difference between the waste nitrogen of metabolism and excretion by the kidney, these two tests are not necessarily parallel and so information from each is supplemental to the other. Consequently all three, phthalein, blood urea, and blood creatinine determinations are useful in the study of cases of nephritis. Very severe cases, as indicated by these tests and their course, may fail to show albumin and casts in the urine, an observation worthy of emphasis to those who tend to limit their study of nephritic patients to examination of the urine for albumin and casts.

¹¹ Quarterly Journal of Experimental Physiology, 1917, x, 203.

¹² Transactions of the Association of American Physicians, 1915, xxx, 305.

¹³ Journal of Biological Chemistry, 1918, xxxvi, 531.

Baumann, Hansmann, Davis and Stevens¹⁴ have made 180 renal dietary tests using in most cases Mosenthal's diet¹⁵ and compared these findings with the results of determinations of blood-urea and uric acid. For normal urea-nitrogen they take 20 mgm. per 100 c.c. blood, and for normal uric acid 2.5 mgm. per 100 c.c. blood. In 100 cases showing slight and moderate, though definite, renal involvement, 66 per cent. showed abnormality in the dietary test, while 74 per cent. showed increased blood uric acid. These figures indicate that uric acid concentration in the blood is a delicate, if not the most delicate, index of renal function that we have available; 35 of these patients showed increased blood urea-nitrogen. Only six times was the uric acid concentration normal when the blood urea-nitrogen was increased. They found no important differences between the results using a bland or a high protein diet. These results indicate that uric acid is frequently increased in the blood with only slight renal disturbance and this minimizes the diagnostic value of uric acid determinations for gout.

Increased Extract Nitrogen in the Tissues in Chronic Nephritis. Foster¹⁶ notes that in some cases with a positive balance between intake and output of nitrogen there is no commensurate increase in the non-protein-nitrogen of the blood. Where is this retained nitrogen stored? This type of case is not growing nor building new tissue, the normal way that retained nitrogen is utilized. Foster records here 14 cases of nephritis which evidenced nitrogen retention during life and which had a chemical analysis of tissues after death. Muscle, liver and brain were considered desirable for analysis, but technical difficulties prevented using liver and brain, so only muscle was analyzed, and in cases necropsied within six hours of death to minimize effects of autolysis. The psoas muscle was used. The normal of this tissue seems to be 1 gm. of nitrogen for 100 gms. of dry substance. The cases of nephritis showed amounts varying from 1.08 to 1.84 gms. per 100 gms. of dry substance. These figures support the view that nitrogen is retained in the body tissues in nephritis—at least in muscle tissue. On *a priori* grounds it has been surmised that retained nitrogen was in the body tissues as well as in the circulating blood and this work merely confirms by figures this surmise.

Low Function and Fair Prognosis. In the author's section on diseases of the kidney in last year's *PROGRESSIVE MEDICINE*,¹⁷ emphasis was given to the need of keeping in mind the chronicity of most cases of nephritis and the consequent importance of repetitions of tests of renal function over long periods of time, if one is to have any very complete knowledge as to the significance of variations from the normal in renal function. Moreover, in determining kidney function, extra-renal factors, as was pointed out there, may play as large a part as intra-renal conditions. Of the very many studies of renal function published in the last few years, the great majority are based on relatively few observations of the given case and the papers were written relatively soon after the

¹⁴ Archives of Internal Medicine, 1919, xxiv, 70.

¹⁵ Ibid., 1915, xvi, 733.

¹⁷ December, 1918, p. 142.

¹⁶ Ibid., 1919, xxiv, 242.

observations. On this account too little importance has been placed on the rate of progression of the lesion, as determined by repeated tests. Furthermore, often there has not been due consideration of and allowance for existing extrarenal factors which may have exerted a large influence on renal function.

Usually, and quite naturally, it has been assumed that a very low renal function justifies a very poor prognosis. If the excretion of phenol-sulphonephthalein is low, zero to 10 per cent., and blood-urea-nitrogen high, 50 mgm. per 100 c.c. of blood or higher, ordinarily it has been thought that the patient's lease of life was necessarily short and the probability of an early renal type of demise reached almost to a certainty. Gradually it has become recognized that these conditions often exist in acute forms of renal lesion and instead of early death remarkable improvements in renal function occur. So, with evidences of acute renal processes, such as much blood and albumin and many cellular casts, we have come to recognize that low degrees of renal function need not have so serious an import as when they are found with no evidences of any very acute renal process.

In contrast to the acute process that rapidly improves and in whom prognosis is much better than the tests of function at that time indicate, there is another little recognized type of case with very low renal function and, notwithstanding this, long duration of life. This type is characterized by an entire absence of signs indicative of activity of renal lesion. The kidney injury is very extensive, but it is progressing very slowly. Excretion is sufficient for the maintenance of life at a fair level of activity and so the patient's condition remains unaltered, until some added change is wrought in the kidney, either by reason of a newly acquired infection or intoxication destroying more renal elements, or from some increased demand on renal function, or to the existing renal lesion is added a circulatory insufficiency or other extrarenal factor that throws a load on kidney function.

Cases of this type have been reported by O'Hare¹⁸ and Christian.¹⁹ The main features in these cases may be summarized as follows:

CASE I (O'Hare, loc. cit.). A girl at nine years had scarlet fever; at eighteen and nineteen a severe anemia. At nineteen, she began to develop vascular symptoms such as spasmodic blurring of sight, cramps in her legs and fingers, occasional dizzy spells and morning headaches. At the age of twenty-three, in May, 1915, she entered the hospital. There was no evidence of sclerosis of the peripheral or retinal vessels. She had a blood-pressure of 165 systolic and 110 diastolic. She had no edema and no changes in her eye-grounds. The urine was of low gravity and contained a slight trace of albumin. There were no casts. The phthalein excretion was 12 per cent.; the blood-urea-nitrogen 59 mgm. per 100 c.c. In November, 1916, her retinal arteries showed some sclerosis. There were a few white spots in the retina. Renal functional tests were identical with those of 1915. During 1917, the patient was apparently well except for headaches. In February, 1918, she had an

¹⁸ Journal of the American Medical Association, 1919, clxxiii, 248.

¹⁹ Southern Medical Journal, 1919, xii, 353.

attack suggesting renal colic with hematuria. Early in April, 1918, she caught a severe cold which was followed by a very severe headache, vomiting, much blurring of vision and edema of the face, neck and upper sternum. Now the retinal arteries showed more sclerosis, there were small hemorrhages in each eye, her blood-pressure was higher, 190 systolic, 120 diastolic. Her phthalein excretion was zero; the blood urea-nitrogen 98 mgm. per 100 c.c. While in the hospital she developed an acute infection of the antrum, became uremic with convulsions, and the blood-nitrogen rose to 168 mgm. She then gradually improved and her blood-urea-nitrogen fell to 70 mgm. The blood-creatinine was 14 mgm. per 100 c.c. On November 30, 1918, the blood-pressure had increased, she now had dyspnea and angina. Her blood-urea-nitrogen was over 90 mgm. per 100 c.c. Uremia developed again, edema developed around her jaws, the blood-urea-nitrogen rose to 120 mgm. and she died the latter part of December, 1918. At no time during the three and one-quarter years of observation did the urine show any signs of active degeneration in the kidney. Hyaline casts even were rare.

CASE II (O'Hare, loc. cit.). A man, aged sixty-two years, had an onset of nephritis in January, 1908, with swelling of the eyes and face following a bad cold. He then had albuminuria and hematuria. In June, 1908, the edema increased and there was dyspnea and orthopnea. The urine showed a large trace of albumin, a few hyaline and granular casts and a moderate number of red and white cells. The blood-pressure was 150 systolic. In October, 1911, his blood-pressure was 190 systolic, 125 diastolic, and the phthalein test showed an excretion of 17 per cent. in one hour. In April, 1914, he was stuporous, drowsy, nauseated and had headaches. His blood-pressure was over 200, his phthalein excretion was zero, and his non-protein nitrogen 130 mgm. per 100 c.c. In March, 1915, he seemed to be in a low state of uremia, his phthalein excretion was 13 per cent. in two hours, his blood-urea-nitrogen 60 mgm. per 100 c.c. In 1916 and 1917 the phthalein excretion was only once as high as 14 per cent.; his blood-urea-nitrogen ran between 40 and 60 mgm. per 100 c.c. In April, 1918, his blood-pressure had dropped to nearly normal and his phthalein and blood-urea-nitrogen were as at previous examinations. In June, 1918, he had convulsions and drowsiness. His urine and renal function were about the same. In September, 1918, his phthalein was zero, his blood-urea-nitrogen between 40 and 50 mgm. per 100 c.c. In December, 1918, he had precordial distress, became drowsy, irrational, had twitching of the hands and feet and finally became comatose. His blood-urea-nitrogen mounted quickly to 200 mgm. and his phthalein excretion remained at zero. He died on January 13, 1919. For nearly eight years his renal function was very low. His urine gave little evidence of an active renal process.

CASE III (Christian, loc. cit.). A man, aged twenty-seven years, who previous to 1917 had frequent attacks of tonsillitis. His tonsils were removed in February, 1917. In 1916 he noticed that his feet became swollen and in the morning his eyelids would be somewhat puffy. On May 8, 1916, he showed some edema, and the spleen was found to be enlarged. On June 29, 1916, his non-protein-nitrogen was 73 mgm. per

100 c.c. of blood; on February 5, 1917, it was 160 mgm. per 100 c.c. On February 24, 1917, it was 136 mgm. and his phthalein excretion was 12 per cent. in two hours and ten minutes. On April 12, 1916, his blood-urea-nitrogen was 56 mgm. and on July 30, 1917, his phthalein was 15 per cent. On September 27, 1917, his blood-urea-nitrogen was 66.5 mgm. per 100 c.c. of blood; on April 30, 1919, this had risen to 163 mgm. and his phthalein was a trace. His blood-urea-nitrogen continued to rise, on May 19 it being 217 mgm. per 100 c.c. of blood. His phthalein remained a trace. His urine contained a trace to a large trace of albumin, as a rule with a few granular casts. The patient progressively lost strength and toward the end he became stuporous. He never had any convulsions. He died on May 28, 1919. He had low renal function observed for three years.

Such patients emphasize the necessity of a somewhat guarded prognosis when, with very low renal function, albumin is not very abundant, blood is absent from the urine, and casts and cellular elements are scant. In them, tests of function and urine examinations need to be repeated at intervals. When they show no changes, the prognosis as to length of life is much better. Such cases evidently live on but a scant margin. Their renal factor of safety is down to the almost irreducible minimum. Another drop may come in several ways and at any time, but until that happens the patient gets along very well, and remains surprisingly free from toxic symptoms. The contrast between this type of case and one with better renal function, which is decreasing and in whose urine there are manifest signs of an active renal lesion, is striking. In the latter, the downward progress is much faster and often a steady one.

A very important extrarenal factor, that is often left out of consideration, is the condition of the circulation. The combination of nephritis and cardiac insufficiency will give low renal function. Often with attention to the circulatory element, that phase of renal function improves markedly and tests, which formerly showed very poor values, now indicate fair renal function. Elements in urinary examination, indicating an active renal lesion, turn out to have their origin from chronic passive congestion of the kidney. So long as a good circulation can be maintained the patient's condition is good and prognosis depends on maintenance of adequate cardiovascular function. Tests of renal function in such cases are fair indices of prognosis only when made during periods of improved circulatory function.

Study of patients of these several types has unquestionably changed our attitude toward tests of renal function. They have impressed the importance of not considering merely the figures of tests of kidney function but the condition of the patient as a whole. Actually, such observations have increased the practical value of tests of renal function in that, if regard is given to the possibility of the occurrence of cases of these several types and they are recognized as they should be by our methods of study, fewer mistakes in prognosis ought to be made. Here again is emphasized that fact, which time and again needs to be driven in, that no single test or no group of tests, however accurate they may be in a technical sense, can ever replace sound common sense considera-

tion of the patient and his disease from every possible angle, utilizing all available methods of obtaining information about the patient. All evidence needs to be weighed with a balanced judgment against the background of medical experience acquired in the long-continued careful observation of patients. This always has been necessary and is required today just as much as ever. Experience teaches us what methods yield most valuable evidence. New methods often give new information and better methods replace older, less satisfactory ones. Obviously the better should replace the poorer in use, but caution is needed to prevent discarding methods which yield important facts and without which our picture of the patient's condition is incomplete. So, too much reliance ought not to be placed on tests of renal function, and yet, used judiciously, they are of the very greatest help in the management of renal cases. Low function, as revealed by renal tests, sometimes is consistent with fair prognosis as shown by the above discussion. It becomes necessary to recognize these types of cases before giving a prognostic judgment in renal cases.

Albuminuria and Casts in Apparently Healthy People. Among the soldiers in the trenches acute or trench nephritis was fairly common. Was this a condition arising *de novo* or did it represent an exacerbation of a preëxisting renal lesion brought about by conditions of trench life? If the latter conclusion is justified evidence of renal disturbance prior to trench life must be present, for once the acute lesion develops, it is not possible to tell whether such changes as are found do or do not indicate some chronic process in addition to the acute. With this in view Maclean²⁰ has investigated the prevalence of albuminuria and casts in British soldiers during training and followed, as far as possible, subsequent developments in these men. In all, 60,000 men were studied, 50,000 in France after completion of training in England and 10,000 at Aldershot early in their training. Morning specimens of urine were examined using salicyl-sulphonic acid. If evidence of albumin was found, this was confirmed by other tests, and search for casts was made. Albuminuria was found in 5.62 per cent. after deducting those where albuminuria was accompanied by pus or spermatozoa and probably was not of renal origin. Deducting those in whom the test was but faintly positive 2.19 per cent. had gross albuminuria, 1.87 per cent. showed casts; 0.84 per cent. epithelial casts alone or in addition to hyaline casts and 1.03 per cent. hyaline casts alone. In 50,000 men, 550 showed casts in large numbers.

Military training quite evidently did not increase the incidence of albuminuria and casts, for, after dividing the men into groups according to length of service, albumin and casts were no more frequent after fairly long service than earlier in service. This it seems to me is particularly important to the practising physician as indicating that, with albuminuria and casts in a patient in good condition, vigorous exercise and hearty diet are not contra-indicated, even though immediately after exercise albumin and casts are increased; this increase is evidently

²⁰ British Medical Journal, 1919, i, 94.

very temporary. My own experience certainly coincides with these observations as indicating that in mild nephritis exercise and generous diet are beneficial and not harmful.

Among these 50,000 men examined, 161 were returned afterward from active service with the diagnosis of nephritis or albuminuria. Of these, only 28 were in the group showing albuminuria before active service, and 15 in the group showing casts before active service. These figures seem to justify the conclusion that albuminuria and cylindruria had little causal relation to subsequent nephritis developing in active service. Furthermore, they indicate that albuminuria and casts found in the urine of apparently healthy men do not greatly increase the likelihood of a relatively early subsequent nephritis; in other words, they are not necessarily of bad prognostic omen.

It would be of great importance to follow this group of men over a long period of time, were that possible. It is a striking fact that though life insurance companies have long discarded as unacceptable for insurance those showing a persisting albuminuria and cylindruria, they do not really know what sort of risks these people are for they have not followed their discards to see what actually happened to them. If they were to do this or even collect the causes and time of death of the group of people rejected from insurance on account of albuminuria and cylindruria, extremely valuable data would be obtained as to the actual average prognostic meaning of albuminuria and cylindruria in the otherwise apparently healthy, data which we physicians need badly.

Bornstein and Lippmann²¹ have studied the occurrence of non-nephritic albuminuria in marching soldiers and in swimmers. Albumin occurs in the urine of certain individuals in the upright position (*Steh-albuminurie*) and in others when marching or exercising (*Gehalbuminurie*). In the latter the urine contains more or less of a substance precipitated in the cold by acetic acid, while in the former this is absent. Following marching, cylindruria and albuminuria are more common than after standing (albuminuria in 60 per cent. of the former and 17 per cent. of the latter). Just the reverse is true of hematuria (13 per cent. after marching, 57 per cent. after standing).

According to these authors, renal circulatory stasis exists in the upright position, anemia of the kidney after exercise. Following exercise the acidity of the urine, as titrated with decinormal sodium hydrate, increases markedly as the result of an increased rate of metabolism. This acidity seems in direct relation to the albuminuria and cylindruria as shown by the fact that they do not appear if the urine is kept alkaline by giving the men doses of sodium bicarbonate. Hematuria, on the contrary, has no relation to urine reaction; in fact, seems less frequent with increasing acidity.

Blood-pressure in Relation to Kidney Disease. Since the advent of apparatus for measuring blood-pressure, much data has been accumulated. At first emphasis was placed on a causal relation between nephritis and blood-pressure, and it came to be generally thought that

²¹ *Ztschr. f. klin. Med.*, 1918, clxxxvi, 345.

a high pressure indicated nephritis. Gradually, with methods of measuring renal function, it was found that a high blood-pressure might be present for a long time, with little evidence of disturbed renal function. The terms, "benign," "essential" or "primary" hypertension came into use to designate such cases. The cause of this condition is not known, and its mechanism is relatively little understood. It seems clear, however, that the kidney bears an entirely different relation to it from that found in hypertension secondary to nephritis, or at least the kidney does not bear any definitely understood causal relation to the increase in blood-pressure. Most important of all to the physician is the fact that in this group with good renal function the prognosis is far better than in chronic nephritis with hypertension. Hopkins,²² under the term "climacteric hypertension," has described a group of such cases.

The characteristics, according to Hopkins, of this group of hypertension cases are its occurrence in women at or soon after the menopause, the absence of fibrosis in peripheral vessels, at least in the early periods of the condition, the absence of infections as etiological factors, the good renal function and the vague symptoms. These patients look healthy; their weight is above normal; often they are obese. These women are energetic, active, inclined to be of an intensely nervous temperament, used to good living and fond of life, but nevertheless subject to many worries and anxieties for years. Gastric and nervous symptoms cause them to seek medical advice; pain in the limbs is frequent. Headache and evidences of cardiac embarrassment come next in frequency.

Hopkins regards this as different from the hypertension seen in men in whom vascular sclerosis is far more prominent and there are many more of the causative factors, such as infections, arteriosclerosis and nephritis. Anemia is exceptional in the women, common in the men. The men show albuminuria and cylindruria, decreased phthalein excretion and slightly increased blood-urea; in women these changes are absent or only very slight. The cause, according to Hopkins, lies in a disturbed relation in the activity of glands of internal secretion brought about by the menopause primarily changing ovarian function and secondarily upsetting the harmonious balance of function existing between the various endocrine glands. Endocrine glands form substances raising the blood-pressure; the adrenal cortex, posterior lobe of the hypophysis and thyroid all elaborate blood-pressure-raising substances. However, Hopkins adduces no direct evidence of disturbance in these glands except that the association with the menopause suggests ovarian changes. None of his cases were observed prior to the menopause and so direct evidence is lacking that the menopause caused the hypertension; hypertension may have existed prior to the menopause; symptoms described by Hopkins occur at the menopause with normal blood-pressure and so the relation of the menopause may be only one of the causal symptoms, which symptoms are accentuated by the hypertension. This assumption appears as reasonable as that of Hopkins; both lack the evidence of observation as to when the hypertension began. The separation between

²² American Journal of the Medical Sciences, 1919, clvii, 826.

hypertension in women and men, as made by Hopkins, does not hold good according to my observations. I am sure that I have observed in men cases identical in every way with the women described by Hopkins. If so, doubt is thrown on a very close causal relation between menopause and hypertension in the women described by Hopkins. The why of hypertension without renal lesion, as it seems to me, remains obscure. Perhaps endocrine glands may play a causal part; proof, however, I think, is lacking. The theory is suggestive and demands close observation and experimentation, but at present it does not deserve acceptance as a demonstrated cause. So much theoretical discussion is now being given to little understood facts in endocrinology that it is necessary to receive with skepticism all explanation based on these theories; they cannot be affirmed or denied with justice on the present basis of our knowledge. This, it seems to me, holds for the endocrine explanation of hypertension.

Riesman,²³ under the title "Hypertension in Women," has described a very similar group of cases to those discussed by Hopkins. These women are usually stout, overweight and undersized; they have born many children; they have neither a history nor any stigmata of syphilis; they are over forty-five years of age, the greater number falling between fifty and sixty; they are practically all constipated and some of them suffer from intestinal indigestion; up to a certain point they show an amazing tolerance to pressures of high degree; in most instances the heart is enlarged chiefly to the left; the arteries are soft and even the retinal vessels rarely show any involvement; the kidneys, as far as it is possible to determine, are competent. Thus Riesman described the group. He calls them "essential hypertension" on account of the absence of gross renal and arterial changes. Riesman recognizes that a similar hypertension is met with in men, but he thinks it is less frequent in men and in general less innocent than in women. As to etiology, he thinks that the worries incident to raising a large family may be of as much significance as the multiple pregnancies; certainly serious worry is rarely absent in these cases. The constipation and intestinal indigestion, which are so common, may have a causal relation. Riesman thinks that the occurrence at the menopause suggests some possible endocrine disturbance probably arising in the ovary. He thinks the hypertension gradually leads to an actual thickening of the muscular coats of the vessels. The inaugural symptoms are interesting. They are dizziness, ringing in the ears, dyspnea on effort, anginoid pains, palpitation, gaseous distention and vasomotor disturbances. Such complications, as brachial neuritis, sciatica, and migraine, Riesman thinks have no connection with the hypertension. The patients are often obese, florid, show signs of increased cardiac and aortic dulness, with a systolic murmur in the aortic area. The peripheral arteries are soft in direct contrast to the blood-pressure. These patients almost constantly have a slightly elevated temperature as they come to the office. The average systolic pressure in the group was 211, diastolic 105, pulse pressure 106.

²³ Journal of the American Medical Association, 1919, lxxiii, 330.

Riesman also described a closely allied type which he speaks of as "non-goitrous thyrotoxic hypertension." These patients are often spare, certainly not overfat; they are near, or past, the menopause; they complain of palpitation and headache, are emotional and have a tendency to sweating; they often have tachycardia and the hands are tremulous. There is often a von Graefe sign but no exophthalmus and no goitre. Whereas there is no positive proof of thyroid cause in these cases and while the patients are nearly all beyond the age at which hyperthyroidism usually appears, Riesman thinks the symptoms nevertheless closely resemble those of thyrotoxicosis. Iodides harm rather than benefit these cases; again, according to Riesman, suggesting a thyroid origin.

In these two groups of cases described by Riesman prognosis is quite good. The high pressures are well tolerated for many years. Hence it is unwise to unnecessarily alarm these patients, but it is desirable, however, to keep them under observation to prevent any possible catastrophes that lie in wait for them, such as angina, apoplexy and cardiac decompensation. In treatment it is not wise to attempt to lower the blood-pressure if the patient seems in good condition. As to diet, it is necessary more often to decrease the quantity than change the quality, as these patients are, as a rule, heavy eaters and they do better on a restricted diet, especially when that is largely lactovegetarian. A lamb chop, a little chicken and fresh fish are permissible. Rest, at times a semi-rest cure, is desirable in many instances. For some persons, however, graduated exercise, walking and moderate golf playing may safely be advised according to Riesman. Nitrites are not indicated. Iodids in small doses over a long period are sometimes useful. Riesman has recently obtained striking results from the use of corpus luteum extracts. When the blood-pressure approaches the danger line and symptoms become very marked, nothing is so valuable as venesection. In the thyrotoxic cases rest is of the greatest importance. Tea and coffee should be forbidden in these. Bromides, at times with small doses of veratrum, seem to do good. A study of the patient's mental make-up is of importance so that the physician may help them to decrease their worry and take a more philosophic attitude toward life.

In a discussion of Riesman's paper, Pratt subdivided high blood-pressure cases with normal renal function into three groups: (1) vasomotor neurosis with transitory hypertension in whom blood-pressure was unusually labile; (2) primary permanent hypertonia; (3) localized arteriosclerosis with hypertension.

According to Bishop, who took part in the discussion, the best remedy of all for this type of case is outdoor exercise. According to him, exclusion of eggs from the diet is very important, and excess of meat should be avoided. Many of these patients abuse laxatives, and Bishop overcomes this by giving them a full dose of castor oil on alternate nights for a week, then skips a week, then two weeks, then three weeks and then advises a full dose of castor oil once a month as long as they live.

Kidney function in relation to hypertension has been studied in 100

cases by Rappleye.²⁴ These were inmates of a State insane hospital. With very few exceptions these patients were in apparently good condition. None were anemic. The blood for the determination of the blood-urea was taken in the morning before breakfast. The blood-pressure in these cases was 150 mm. of mercury or higher. Eighty of the 100 were patients of fifty years or more in age. When the blood-urea-nitrogen was 15 mgm. or less per 100 c.c. there was little or no evidence of any sort of renal disturbance. In only 29 of the cases was the blood-urea-nitrogen 16 mgm. or higher. There seemed to be little if any relationship between the blood-urea-nitrogen and the blood-pressure, either the systolic, diastolic or pulse pressure. On the other hand, there was quite a close relationship between the phenolsulphonephthalein excretion and the blood-urea-nitrogen, whereas there was practically no relationship between the phenolsulphonephthalein excretion and the blood-pressure.

These observations of Rappleye are in accord with those of others, indicating that hypertension is often unrelated to disturbances in renal function and with the high blood-pressure often renal function is quite normal. It would seem probable that long-continued high blood-pressure may be a factor in producing renal disturbance, or, at least, an accompanying vascular lesion may lead to nutritional disturbances in the kidney that eventually decreases its function. In this sense the finding of hypertension, while not necessarily indicating a nephritis, may connote that chronic nephritis will soon supervene.

Hirose²⁵ has studied amyloid disease of the kidney with reference to its association with nephritis and blood-pressure. He finds that in a series of 59 cases the presence of amyloid in the kidneys has always been associated with chronic nephritis. It is impossible to determine whether the nephritis antedated the amyloid or was developed coincidentally with it. In 40 cases in which measurements were given, the kidneys were larger than normal, while in nine they were small and granular. In all but one of the 15 cases in which the blood-pressure was recorded it was found to be normal or below normal. In the one case in which the systolic pressure was 170 mm., the kidneys were rather large and there was no cardiac hypertrophy. Of the 59 cases, 10 showed cardiac hypertrophy, but only one of these was associated with small granular kidneys, and in none was high arterial tension noted.

It appears from these observations that even if it be assumed that a persistent nephritis produced cardiac hypertrophy and hypertension, the advent of the amyloid-forming process must have reduced the blood-pressure to a low point and may even have caused a retrogression in the size of the heart.

Renal Function in Intestinal Obstruction. Apart from nephritis, not many conditions cause a decreased phthalein excretion and an increased content of the blood in non-protein nitrogenous substances. One of these, however, is intestinal obstruction in which, in 1914, Tileston and Comfort²⁶ reported a rapid increase in the non-protein-nitrogen of the

²⁴ Boston Medical and Surgical Journal, 1918, clxxix, 441.

²⁵ Johns Hopkins Hospital Bulletin, 1918, xxix, 191.

²⁶ Archives of Internal Medicine, 1914, xiv, 620.

blood in a small number of human cases. Recently McQuarrie and Whipple²⁷ have reported observations on renal function in experimental intestinal obstruction and following injections of proteoses in dogs. They used the urea excretory capacity of the kidney as measured by the ratio of urea in one hour's urine to the urea in 100 c.c. of blood as suggested by Addis and Watanabe, the rate of elimination of phthalein and the rate of excretion of injected sodium chloride as indices of renal function. With intestinal obstruction they observed a heaping up of urea in the blood and a decreased excretion of phthalein, urea and sodium chloride. All these indicate disturbed renal function yet histologic study revealed no kidney lesion. With relief of the intestinal obstruction and clinical recovery, kidney function returns promptly to normal. If proteoses are prepared from the contents of obstructed intestines and injected intravenously into otherwise normal dogs, toxic symptoms result similar to those found when intestinal obstruction is produced. With this goes impairment of renal function with quick return to normal after the disappearance of toxic symptoms. A number of proteoses of other origins were used but these produced very little in the way of symptoms similar to those occurring in intestinal obstruction and here renal function was little, if any, reduced. As pointed out by the authors, this is one of the first instances observed in which a marked kidney injury or impaired function has been demonstrated by functional methods which was unaccompanied by demonstrable anatomical change and which was followed very quickly by repair with a return to normal function with no trace of permanent injury.

Effect of Diets on Renal Function. The specific gravity of the urine and the elimination of fluids, salt and nitrogen can be used as measures of the efficiency of renal function. Hedinger and Schlayer²⁸ proposed as a test of renal function the amount, specific gravity and sodium chloride content of the urine collected in two-hour portions throughout the day and in a single specimen at night. They placed their patients on a special diet rather high in proteid and containing a considerable amount of diuretics such as fluid, salts and purins. Mosenthal²⁹ and O'Hare³⁰ have modified the diet to suit American patients better. Mosenthal³¹ recently has studied the effect of diets on the results of this test, a test often spoken of as the "two-hour renal test" or the "test renal day."

Mosenthal has observed three diets: (1) a high protein diet which contains about the same protein content (13.4 gm. nitrogen) that a normal person with good appetite would consume; (2) a low protein diet (3 to 4 gms. nitrogen); (3) a normal diet consisting of such food as the patient chooses. Under all diets no fluid was taken between meals and the night collection began three hours after the evening meal. Observations were made at different seasons of the year. In more than 100 observations on normals, only once was the maximum specific

²⁷ Journal of Experimental Medicine, 1919, xxix, 397 and 421.

²⁸ Deutsch. Arch. f. klin. Med., 1914, cxiv, 120.

²⁹ Archives of Internal Medicine, 1915, xvi, 733.

³⁰ Ibid., 1916, xvii, 711.

³¹ Ibid., 1918, xxii, 770.

gravity lower than 1.018 whether the diet was high, low, or normal as defined above.

To obtain further information in regard to variations in specific gravity, some of the normals were starved and given a constant quantity of water at two-hour intervals. Even under these conditions there was a maximum concentration of 1.020 or over. This results from the fact that in spite of the constant water intake there is, at intervals, a large urine output followed by a period of comparative oliguria. Specific gravity varies in inverse proportion to the quantity of fluid excreted and the variability in water output is responsible for the variations in specific gravity. The quantity of nitrogen remains fairly constant from period to period; sodium chloride has a tendency to be much higher in the morning hours than in the afternoon on the first day of starvation.

In normal individuals, on high or low diets, there is usually a variation of specific gravity of 9 points or more, while on the "normal diet" it may be much less. This latter result comes from the less consumption of fluid when the patient selects his own diet than when on the special diets used to make up the high or low protein values. This variation of 9 points in the specific gravity then is the normal. Less may not be abnormal but point only to a deficient supply of water to drink.

In earlier work, Mosenthal had regarded the normal night amount of urine as 400 c.c. or less. The present observations have changed the limit of normality to 750 c.c. Mosenthal's revised normal standard can be expressed as follows:

	Diet.		
	High.	Low.	Normal.
Maximum specific gravity	18+	20+	20+
Degrees variation of specific gravity, usually	9+	9+	No value.
Specific gravity of night urine	Of no significance.		
Volume, cubic centimeters of night urine	750 c.c. or less.		
N and NaCl per cent. in night urine or highest per cent. in any specimen	Normal if 1 per cent. or higher, not necessarily abnormal if less.		

As a basis for estimating these changes in abnormal individuals, 114 patients were studied whose range of condition is given in this table:

Diagnosis.	Number of cases.
Chronic nephritis	58
Essential hypertension	21
Acute nephritis	13
No renal disturbance	6
Pyelitis and cystitis	4
Cardiac disease	4
Marked anemia	3
Hyperthyroidism	3
Spinal cord injury and paralysis of bladder	1
Polycystic kidneys	1

Twenty-one of these patients showed a night polyuria, more than 750 c.c. This appeared almost entirely while on the high diet (19 out of 21). This suggests that with the increased solids of the high diet the

defective kidney could not eliminate sufficiently large an amount in the day, while on the low diet the defective kidney was not so over-taxed. This indicates a therapeutic advantage in the restricted intake of the low diet.

In one patient an increased water intake actually led to a decreased urine in the succeeding period, indicating that so bland a diuretic as water might fatigue the kidney.

It is of interest that of the 21 cases classified in the table as hypertension, only 3 showed nocturnal polyuria.

High or low diets made very little change in maximal specific gravities nor in the degree of variation in specific gravities.

Marked variations in results were brought about by the elimination of edema. When edema is present, the change from oliguria to polyuria may come with extreme rapidity and influence the interpretation of renal function. This possibility must be kept in mind when interpreting the results of the test applied to nephritics.

Renal Action in Acute Nephritis. Six patients with acute nephritis and 2 giving a history of previous renal disease, though at the time of observation in acute attacks similar to the first group, were studied very carefully by Atchley³² during the course of their disease. A test renal day or two-hour renal test was done on 5 of the patients. This test, however, was done late in the hospital observation when water balance had been restored and renal function probably was not very abnormal. This last fact may minimize the significance of the strictures which Atchley places on the test, namely, that it contributed little of value and in acute nephritis may be quite misleading.

Phthalein excretion showed a wide range of values and often was far from consistent with the clinical and other laboratory findings. The gross changes in excretion, however, were of considerable significance. In acute nephritis variations above a level of 20 to 25 per cent. were rarely of real functional significance; below 20 per cent. they were of more serious import as indicating extensive degree of involvement. In my own experience with acute nephritis, phthalein excretion may be quite low and then very quickly rise; remaining low, it is an indication of serious involvement. Then I have often seen phthalein excretion quite high when there was a very active process going on in the kidney and with very evident improvement in the patient phthalein will fall, though not to a low figure, and after a time gradually rise again to a more nearly normal level. The curve of the phthalein excretion over a fairly long period, rather than its value at single observations, is what throws light on renal condition.

Blood-urea determinations, in Atchley's opinion, furnish the most valuable means of determining the degree of progress in a case of acute nephritis; the absence of nitrogen retention, however, is not a necessary indication of a prompt recovery.

In regard to the Ambard coefficient or McLean index, Atchley thinks them, as well as their fundamental formulæ, quite untenable as the expres-

³² Proceedings of the Society for Experimental Biology and Medicine, 1918, xv, 85, and Archives of Internal Medicine, 1918, xxii, 370.

sion of a physiologic law but regards them as having a place as a rough clinical test of one aspect of renal function. Atchley says, "on determining a number of indexes and observing the wide discrepancies found in the same person, normal or pathological, the inclination is strong to discard the formula entirely. Further determinations, however, demonstrate that the basal laws may be applied in a very general way, and that the index, if interpreted liberally, may often contribute something of value to the diagnosis, although isolated determinations may lead far afield." In only one of his cases was there constant agreement between the Ambard and phthalein excretion, while in the majority there were striking discrepancies. Even a moderately rigid interpretation of the Ambard as a real index of the degree of impairment of urea function may lead to the greatest error. On the other hand, a series of determinations in a given case show a fairly consistent agreement between Ambards and other evidences of the state of renal function.

In Atchley's group of patients, the sequence of events in diuresis could be followed satisfactorily in 2 cases. From these it seems clear that the salt function is the first to be regained, followed at varying intervals by the pouring out of water with a coincident decrease in weight. In one case salt excretion began to increase ten days before the increase in water output or drop in weight was evident. Skin and lungs assume a large share in the excess excretion of water. One case had a daily loss of 1100 c.c. and 1285 c.c. to be accounted for by vaporization. Actual loss of salt indicates that the fluid lost to decrease weight has about the same concentration in salt as does the blood, in other words, there is no storing of chlorides in a concentration above that of the blood. As convalescence from the acute nephritis developed, these patients were able to handle added salt without increase in weight.

Total salt content of the body, apparently, may increase with a diminishing salt concentration in the blood plasma; there may be a very great change in plasma chloride concentration independent of intake or urinary excretion, and paradoxical to the apparent chloride balance. In no case was the rate of excretion clearly dependent on the concentration of plasma chloride. With identical plasma chlorides the rate of excretion showed the widest variation under different dietary regimes. According to Atchley, study of these cases furnishes data to demonstrate the physiological impossibilities of the fundamental theory of the McLean chloride index. There is no definite constant threshold for salt for any individual nor is the height of the threshold an index of the degree of impairment of chloride function.

Atchley regards restriction of salt intake as the first step in the treatment of acute nephritis. Empirically, it is wise to give a low protein diet in all cases of acute nephritis, the degree of restriction depending largely on the amount of urea in the blood; when there is no retention of urea 8 to 10 grams of nitrogen is a safe intake. Limited fluid intake (1200 c.c.) is the method of choice.

Acute Nephritis without Albuminuria, or Acute Functional Renal Adynamiesis, a title which Franke³³ uses to describe a very interesting

³³ Ztschr. f. klin. Med., 1918, lxxxvi, 281.

group of cases, which show the features of acute nephritis but with a urine free from casts and albumin. All were soldiers. The onset was without warning; edema was the first symptom, appearing first in the face, then in the thorax and legs. The edema was soft, painless and developed rapidly. The history indicated a pre-edema stage of malaise, pain in the feet and back, slight fever, cough and headache. With development of edema, dyspnea often appeared and rales were present. There were no signs of cardiac failure and the soldiers were in good nutrition. This clinical picture certainly is in close accord with that seen in the average case of acute nephritis.

The evidence for a renal lesion in this group lies in the results obtained from tests of renal function. As tests were used the amount excreted of 10 grams of sodium chloride and 20 grams of urea added to the diet and the time of excretion of milk sugar given intravenously, of sodium iodide given by mouth and the excretion of a dyestuff (uranin). According to the author, some or several of these showed decreased or delayed excretion. With the exception of uranin, these are all tests I have had experience in using. Review of the results in Franke's cases show for the most part relatively slight departures from the average normal so far as uranin, milk sugar and sodium iodide are concerned; in most patients these are normal. In several (4 out of 17) sodium chloride excretion was definitely decreased and in somewhat more cases urea excretion was retarded. However, on the whole his figures for most cases are near enough the normal to be of no great significance as indicative of a renal lesion. Moreover, experience has taught that these tests which Franke used are not the most satisfactory and trustworthy of the tests for renal function. None of his cases died, so there is no anatomical evidence of renal lesion. Taken as a whole, the evidence for a renal lesion seems meagre. Still the cases are of great interest as representing an acute general edema certainly extremely rare except under war conditions and if not of renal origin of unknown cause, though other observers have explained them as being of dietary origin, possibly analogous to one of the two food deficiency diseases described in this country by McCollom.³⁴

Nephritis in Children. In PROGRESSIVE MEDICINE for 1918³⁵ the writer reviewed a paper by Hill.³⁶ The same author³⁷ has recently published a second paper on nephritis in children in which he discusses classification, etiology, prognosis and treatment from a practical clinical viewpoint.

Hill adopts a *simple clinical classification*:

	Cases.
Acute hemorrhagic nephritis	25
Acute exudative nephritis	24
Subacute nephritis	4
Chronic nephritis (ordinary type)	21
Chronic nephritis with infantilism	1

This seems a sane grouping of cases and is quite in accord with my own views as to a classification practically applicable to adults. In adults, the difficulties are greater, inasmuch as cardiovascular degenerative

³⁴ Oxford Medicine, Oxford University Press, 1919, i, 43.

³⁵ December, 1918, p. 150.

³⁶ American Journal of Diseases of Children, 1917, xiv, 267.

³⁷ Ibid., 1919, xvii, 270.

changes enter to complicate the picture while such disturbances are of very infrequent occurrence in children.

The characteristics of the "acute hemorrhagic type" are bloody urine, moderate albuminuria, considerable number of pus and normal kidney cells and a very few casts. The child usually does not look very sick; edema is very slight or absent; blood-pressure may be slightly elevated; the heart is normal in size; prognosis is good.

In the "acute exudative type" there is moderate or excessive edema. In mild cases there is a somewhat diminished amount of urine, moderate albuminuria, moderate number of red cells and many casts. Sometimes a good deal of blood is present. Oliguria always exists at some time during the disease. Blood-pressure is always moderately elevated, functional tests show decreased renal activity. In the severe cases all of these changes are much more marked. With marked edema, excretion of salt is very poor, and blood-urea is increased. Uremic attacks are likely to occur. The patients may die in acute attacks but if they survive they are likely to recover entirely.

The "subacute cases" are not common. Following acute hemorrhagic nephritis a small amount of albumin and a few red cells persist for several months or as long as a year. During this time the patient seems well. Functional tests give almost normal values.

"Chronic nephritis (ordinary type)" gives a varying clinical picture which Hill thinks represents varying stages or phases of much the same process. Some run a surprisingly mild course and physical examination reveals little besides a slight anemia. In these there is a moderate amount of albumin, and a few casts. Functional tests are nearly normal. In the more severe cases the picture is like the adult type of "chronic diffuse nephritis." These children are anemic and show the characteristic facies and pale waxy skin seen in adults. Edema is usually abundant, urine scant. There is a large amount of albumin and many casts, often including waxy and fatty casts; usually there are a few blood cells. Functional tests show a severely damaged kidney and uremia is not uncommon.

"Chronic nephritis with infantilism" is a rare form which may be familial in type. It resembles the chronic interstitial type of adults with high blood-pressure, etc. Infantilism in these cases might, it seems to me, be due to the vascular changes which, appearing early in life, interfere with nutrition and retard development and growth.

Etiology. Hill regards infection as a very frequent cause of nephritis in children, particularly tonsillitis.

	Acute nephritis.	Chronic nephritis.
Tonsillitis	14	8
Unknown etiology	15	11
Scarlet fever	4	4
Impetigo	4	
Otitis media	4	4
Pneumonia	2	
Tonsillectomy	2	
Purpura	2	2
Cervical adenitis	1
Carious teeth	2	
Stomatitis	1	
Cold	1	

Among those tabulated as unknown, Hill thinks tonsillitis was an important factor as nearly all of the children in this group had large unhealthy-looking tonsils. Hill's views accord very closely with my observations in adults in whom acute nephritis usually develops soon after an infection of the respiratory tract with rhinitis, sinusitis, tonsillitis, pharyngitis or bronchitis singly or in combination.

As to the *symptoms*, one of the striking things is that most of the children do not seem sick. Only 8 of 49 acute cases could be said to be dangerously sick and only one died; 25 of 49 acute cases showed varying degrees of edema; sometimes edema was very slight and in only 8 was it extensive. Of 25 subacute and chronic cases, 17 showed edema. In many cases blood-pressure was normal. In acute nephritis an elevated blood-pressure does not necessarily carry with it a bad prognosis nor does normal blood-pressure indicate a good prognosis: On the other hand, in chronic nephritis a consistently and considerably elevated blood-pressure means that the case is a very severe one. Heart hypertrophy was too slight to detect clinically in Hill's cases.

Phenolsulphonaphthalein excretion in normal children is higher than in normal adults, averaging 76 per cent. In 21 acute cases the average was 59 per cent., the lowest figures being 20, 30 and 43 per cent. Several very severe cases showed a normal excretion. Hill considers a low excretion not necessarily a bad prognostic sign in acute lesions and a high excretion does not mean that the prognosis is good. In children, Hill does not consider the phthalein test of any great practical value.

Blood-urea determinations were made in 12 cases and a high value was found to be a bad prognostic sign in both acute and chronic cases. This is not necessarily true of acute nephritis in the adult according to my experience. The *two-hour renal test* Hill found more delicate than phthalein excretion or blood-urea determinations. On the whole, in acute nephritis of children, Hill has not found functional tests of great value while in chronic nephritis they are of considerable value, especially in prognosis.

Treatment is chiefly dietary. Salt-poor diet is advised when edema is present and its results in clearing the edema are often striking. Protein intake is reduced and it is usually sufficient to omit meat, eggs and fish. A typical diet for a boy of five years weighing 40 pounds on which he was kept forty-four days without tiring of it and without losing weight, is as follows:

Food.	Amount.	Calories.	Protein, gms.
Oatmeal	2 tablespoonfuls	70	0.3
16 per cent. cream	2 ounces	107	1.8
Sugar	4 drams	100	
Bread	3 slices	225	0.9
Butter	2 cubes	450	
Peas	1 tablespoonful	40	0.3
Potato	1 tablespoonful	70	0.2
Custard	2 tablespoonfuls	110	0.5
Orange juice	6 ounces	78	
Ice-cream	2 tablespoonfuls	77	0.9
		<hr/> 1327	<hr/> 24.7

In the acute cases, when the urine becomes normal the child should return to his usual diet, and in subacute and chronic cases it is important not to restrict diet too much; they should have meat once a day. As to water, as much should be allowed as the kidney can handle. Without edema, 48 ounces per day is about right. With edema, fluid intake should be reduced, but not below 10 to 12 ounces, while some edematous patients seem to be better on more. Diuretics are not used in acute cases. In chronic ones with edema theocin or theobromine salicylate may help in removing edema.

Edebohl's *decapsulation* operation was done on 8 very severe cases. In 4 it did no good; in one acute case it probably saved life but did not prevent the development of a chronic process. In one chronic case, it helped much. In one acute and one chronic case, it undoubtedly saved life and apparently cured.

As to *prognosis*, of 52 acute cases, 2 died and 4 developed chronic nephritis. Hill thinks if the children apparently recover from the acute attack they are no more liable to subsequent nephritis than those who have had no acute attack.

Plasmapheresis in Chronic Nephritis. In 1914, Abel, Rowntree and Turner³⁸ used the term plasmapheresis to signify removal of the corpuscles of the blood from the fluid constituents either by bleeding, washing and returning to the circulation the red cells suspended in Locke's or similar solutions, or by a method of dialysis *in vivo*. O'Hare, Brittingham and Drinker³⁹ have applied this method 18 times on 8 patients with nephritis, bleeding by the citrate method and returning the washed red blood corpuscles minus the plasma. They report 1 case, and in discussion say, "Plasmapheresis, in so far as it was carried in this case, has not arrested the march of uremia in any degree. The encouraging betterment which is noted early in the patient's stay in the hospital is no more than one often sees from rest and proper diet. Whether plasmapheresis can be carried to greater extent remains to be seen, but it seems improbable that real good can come from it in chronic cases with impending uremia. The other patients on whom we have used the maneuver have been of similar type and have received no benefit from it or from blood transfusion. It is possible that a case of acute nephritis with suppression of urine might be tided through a critical period of impending uremia by repeated plasma removals, but our series does not contain any such case.

It is of some interest to note that the urea-nitrogen of the plasma increases slightly during the process of blood dilution. This finding corroborates that of Turner, Marshall and Lamson⁴⁰ and cannot be explained without more complete studies on nitrogenous metabolism than we at present possess."

Experimental Nephritis. Animal experimentation has thrown much light on the problem of human acute nephritis for, in the animal, lesions can be produced quite analogous to some types, at least, of human acute

³⁸ Journal of Pharmacology and Experimental Therapeutics, 1914, vi, 625.

³⁹ Archives of Internal Medicine, 1919, xxiii, 304.

⁴⁰ Journal of Pharmacology and Experimental Therapeutics, 1915, vii, 129.

renal changes. However, where knowledge is most needed, namely of chronic nephritis in man, very little real help so far has come from the experimental method because of the great difficulty of producing with regularity in the experimental animal anything very similar to the human chronic lesions. Even when chronic lesions have been found in animal kidneys, following some method of injuring the kidney, the doubt always exists as to whether or not the observed lesion may not have been spontaneous and in no wise related to the method used. That some of the chronic lesions, that have been described in experiments, were of spontaneous origin, there can be no doubt, but how often this is the case cannot be said.

Bloomfield⁴¹ attempted to produce chronic renal lesions by the following method: A bacterial suspension (streptococci) was injected directly into one renal artery. Two weeks later intravenous injections of the same bacteria were made and repeated at intervals over periods varying up to fifteen months. This produced no very definite lesions. Various focal lesions, such as round-cell infiltration and scar tissue formation, were encountered but these seemed of spontaneous origin because in most instances they occurred in kidneys which showed scarring on inspection in the beginning of the experiment at the time of injection into the renal artery and did not appear in kidneys which at that time were smooth and normal looking. Bloomfield regards these lesions as spontaneous and points out their similarity to those reported as the result of various experimental methods used by others in the effort to produce an experimental chronic nephritis.

MacNider has taken advantage of spontaneous renal lesions in animals to make certain studies of renal function in the dog. In the dog the lesions resemble some forms of chronic renal lesion in man and so presumably function in them is closely analogous to that in some forms of human nephritis. Recently, MacNider⁴² in several papers has reported studies on the function of natural nephropathic animals. He finds that, compared with normal dogs, they show to a slight degree an increased blood-urea-nitrogen, a decreased phenolsulphonephthalein excretion, albuminuria and cylindruria and usually a normal acid-base equilibrium. Grehant's anesthetic, as given, in a half hour produced very little change in the renal function in the normal dogs, while in most of the naturally nephropathic dogs anuria rapidly developed with a rapid depletion in the alkali reserve when they became anuric. If alkali reserve was depleted these dogs showed no diuretic response to caffeine, theobromine or pituitrin, while if there was no change in alkali reserve these substances produced diuresis. In one hour all of the naturally nephropathic dogs were anuric, with depleted alkali reserve and no diuretic response. The characteristic and constant histological change induced by the anesthetic is swelling, vacuolation and necrosis of the epithelium of the convoluted tubules and a rapid accumulation of fat in Henle's loop.

The naturally nephropathic animal shows lesions largely confined to

⁴¹ Johns Hopkins Hospital Bulletin, 1919, xxx, 121.

⁴² Journal of Experimental Medicine, 1918, xxviii, 501 and 517; Journal of Medical Research, 1919, xxxix, 461.

glomeruli and interstitial tissue but there is no change in the acid-base equilibrium. With an anesthetic, evidence of acid accumulation occurs, and with it epithelial degeneration is present and urine output rapidly falls. Epithelial degeneration appears to be associated with the acid accumulation, while the injury to the glomeruli, as encountered, evidently is not caused by an acid intoxication.

Dogs can be protected to a considerable degree against the effects of the anesthetic by sodium bicarbonate given intravenously. Protection depends on success in maintaining the alkali reserve. It does not appear from this work just how the increase in hydrogen ions leads to an injury to the epithelium or what the mechanism is that prevents this when an alkali solution is given.

Salant and Swanson⁴³ have found that, in an experimental nephritis in rabbits produced by tartrates, a diet of carrots exerts a distinct protective action, in the sense that when fed carrots, tartrates decreased renal function as measured by phenolsulphonephthalein much less and recovery was prompter and more complete than when the rabbits were on a diet of oats. They offer no explanation of this effect. Possibly it is a mechanism similar to that in the protection described by MacNider for sodium bicarbonate against the action of anesthetics in naturally nephropathic animals.

Naturally nephropathic kidneys were found by MacNider very susceptible to mercuric chloride intoxication, and this toxic effect has been associated with the development of an acid intoxication.

Watanabe, Addis, and their associates, have been investigating renal function in relation to structure in the hope of finding some satisfactory measure of the amount of secreting kidney tissue present. In such a study Watanabe, Oliver and Addis⁴⁴ have followed a method previously worked out by Addis and Watanabe⁴⁵ of subjecting the kidney to an increased demand on its activity by the feeding of urea and then calculating the ratio between blood and urine urea. They point out that a disturbance in urea excretion might reveal itself in a number of ways; the rate might be diminished; without change in rate water excretion might increase and so decrease urea concentration in the urine; rate and concentration in the urine might remain unchanged and urea concentration in the blood increase; there might be alterations in the ratio between urinary and blood urea concentration or in the ratio between the rate and the blood concentration. In their experiments, varying degrees of degenerative change were produced in rabbits with uranium acetate and the animals were grouped in three classes, those with slight lesions, moderate lesions and severe lesions.

Their experiments were carried out in the following way: Food and water were withheld for seventeen hours; blood was obtained from a ear vein; the bladder was emptied and urea was given by stomach tube. The rabbits were then rebled and catheterized each hour for three hours and again at the end of the fifth hour. After four days a subcu-

⁴³ Journal of Pharmacology and Experimental Therapeutics, 1918, xi, 43.

⁴⁴ Journal of Experimental Medicine, 1918, xxviii, 359.

⁴⁵ Journal of Biological Chemistry, 1916-1917, xxviii, 251.

taneous injection of uranium was given and seventy-two hours later the bleeding and catheterization was repeated at intervals as before. Blood and urine urea was quantitated by the usual technic.

Following this method they found that the ratio between urea content of the urine and blood (concentration of urea in urine divided by concentration of urea in blood) disagreed with the anatomical classification in but two instances and was the most satisfactory means of expressing the renal function as a measure of the amount of excreting renal substance. The ratio decreased in quite direct relation to the decrease in renal tissue as brought about by the action of uranium.

In the contrast to these results, Watanabe⁴⁶ found that small doses of arsenous acid, which produce incipient glomerular nephritis, increase the ratio of the concentration of urea in the urine to the concentration of urea in the blood indicating a state of hypersensitiveness rather than a decreased function.

MacNider,⁴⁷ with the title, "A Functional and Pathological Study of the Chronic Nephropathy Induced in the Dog by Uranium Nitrate," arouses interest and creates the hope that a lesion analogous to chronic nephritis in man has been produced experimentally. The reader, however, will be disappointed on this score for the kidneys show no really chronic lesions and only four animals ran more than twenty-one days of experiment, two being killed on the thirty-fifth day and two on the forty-eighth day. He does, however, present an excellent study of renal function after an acute toxic lesion in the dog and, in a number of animals follows the healing process by the changes in function as measured by phthalein elimination, blood urea, alkali reserve of the blood, and the tension of the alveolar air carbon dioxide. MacNider points out that uranium nitrate is relatively more toxic for old animals than for young animals. In the older animals there is greater disturbance in renal function following the toxic dose and improvement takes place much less readily.

Burns, White and Cheetham⁴⁸ have utilized a new substance, tetraoxymcury phenolsulphonephthalein, to produce experimental nephropathy. This substance produces, in the acute stages, lesions mainly tubular in type. In the chronic stages they claim to produce an increase in interstitial tissue both in the glomeruli and between the tubules together with areas of tubular obliteration and of glomerular fibrosis. The photomicrographs, however, which are given, do not suggest chronic changes such as one sees in human kidneys. The authors do not give the technic for handling their tissues, but the pictures suggest a form of artefact which is not uncommon in formalin-fixed tissue sectioned after freezing. As published, their work hardly seems to justify their claim that "the renal lesions produced by the administration of tetraoxymcury phenolsulphonephthalein resemble closely those found in the different types of nephritis in human beings and it is hoped that by further study lesions of the very extreme chronic type can be produced,

⁴⁶ Journal of Urology, 1918, ii, 227.

⁴⁷ Journal of Experimental Medicine, 1919, xxix, 513.

⁴⁸ Journal of Urology, 1919, iii, 1.

such as the small contracted kidney with its accompanying cardiovascular change."

Pathological Studies of Renal Lesions. Fahr⁴⁹ recently has elaborated the conception of focal glomerulonephritis which was presented in the monograph of Volhard and Fahr⁵⁰ published in 1914. He points out that the glomeruli particularly well show all phases of inflammatory change, degeneration, exudation and proliferation and usually these are present in varying combination. The most marked example of degeneration comes in the embolic focal glomerular lesions, but even here usually there is evidence of some degree of exudation and proliferation.

These various types of lesions can be grouped together conveniently under the heading focal glomerular nephritis in contrast to the diffuse glomerular nephritis, so that we may classify glomerular nephritis as follows:

I. Diffuse glomerular nephritis.

II. Focal glomerular nephritis.

(1) Toxic in origin.

(2) Bacterial in origin.

(a) Thrombotic.

(b) Embolic.

The toxic type of focal glomerular nephritis has its analogy in experimental uranium lesions where injury is produced to the capillary wall of certain glomeruli, which may be severe enough in some places to produce rupture with hemorrhage and in others necrosis of the wall with subsequent thrombosis. Fahr describes a human case with similar lesions; a girl of two and three quarter years, following scarlet fever, had diphtheria, and at autopsy showed focal hemorrhages in an acutely swollen kidney. Under the microscope, glomeruli showed degenerative changes in the walls of some of the capillary loops, and some of the capillary loops were dilated and filled with blood. In places, capillary loops of the glomeruli showed small areas of necrosis. In a second patient of nine years dying of peritonitis, degenerative changes were more marked in the glomeruli, with hemorrhages. Capillary walls were thickened, but there was no endothelial proliferation. The epithelium of some tubules containing blood was necrosed or flattened. Bacteria could not be found, and Fahr considers these changes as of toxic origin. They differ from the embolic focal glomerular changes in that there is no obstructing clot or bacterial aggregation large enough to stop the capillary lumen. Fahr thinks a few bacteria probably penetrate the capillary wall and lead to changes as a result of their toxins. In a sense these lesions represent a transition or an intermediate stage between a diffuse glomerular nephritis and an embolic focal lesion. This is especially well shown in a patient dying of a pneumococcus meningitis. In this kidney, dilated capillary loops were seen with injured walls and escaping blood, and in other places proliferation of the endothelial cells of capillaries and of the capsular epithelium was found as in the diffuse type of glomerular nephritis. Some tubules were filled with blood but

⁴⁹ Virchow's Archiv f. path. Anat., etc., 1918, ccxxv, 24.

⁵⁰ Die Brightsche Nierenkrankheit, Springer, Berlin, 1914.

showed very little other change; others showed flattened or necrotic epithelium. In the latter, cocci were abundant, whereas in the glomeruli no bacteria could be found. The glomerular changes evidently were not due to thrombosis interfering with circulation but to local toxic effects; not an embolic but an excretory process.

Fahr explains, too, certain focal interstitial lesions in a similar way and illustrates this by a case dying of purpura variolosa in which there was interstitial infiltration with lymphocytes and plasma cells, glomerular hemorrhages and intact parenchyma.

In contrast to these lesions is a case of otitis media with thrombosis of the cerebral veins, in which glomeruli showed foci of coagulation necrosis due to aggregations of cocci obstructing capillary loops. In this type of lesion hemorrhage is an indirect result of the infarction, while in the toxic type it results from rupture of the injured wall of the capillary. As a result, hemorrhage occurs much sooner and more markedly in the toxic group of focal glomerular lesions.

In still another type of focal glomerular lesion, exudation appears in the foreground. Here leukocytes accumulate in the capillary loops, apparently in sufficient numbers to obstruct and cause focal necroses. Accompanying this there is more or less proliferation of capsular epithelium. Two cases of this type are reported, one dying of empyema and peritonitis, the other of phlegmon of the leg and pneumonia. In these the obstruction of capillaries is thrombotic, not embolic.

These various lesions are in contrast to the more generally recognized type of focal glomerular lesion of embolic origin. In these, the source of the emboli is in a vegetative endocarditis, usually of *Streptococcus viridans* origin. In his discussion of these lesions, Fahr makes no reference to work outside of Germany, though much of what he describes has been reported previously, particularly in American literature, as long ago as ten or more years prior to Fahr's publication.

In Fahr's study of focal glomerular nephritis, frequent reference is made to the origin of renal hemorrhages. This has been further studied by Rochs⁵¹ under the title of hemorrhagic nephritis. Rochs thinks that hematuria in the great majority of cases is due to disturbances in the glomerular capillaries; that blood in the urine usually indicates a lesion of the glomerulus. Hematuria is a very early accompaniment of acute nephritis; however, it is important to recognize that not infrequently a marked hematuria occurs in the later stages of an acute nephritis and marks the beginning of healing while at other times it accompanies an exacerbation of the disease which ends fatally.

These rather contradictory findings may be explained as follows: In the earlier stages of a focal or diffuse glomerular nephritis glomeruli are injured in the sense that a lesion of the capillary wall allows of the escape of blood into the capsule and thence into tubules to appear finally in the urine. A little later various changes, particularly proliferation or embolic stoppage of glomerular capillaries, decrease glomerular circulation and obstruct escape of blood from the capillaries. Conditions

⁵¹ Virchow's Archiv f. path. Anat., etc., 1918, ccxxv, 60.

improve, capillary circulation is restored in the glomerulus, and again blood escapes to cause hematuria. Under these conditions urine excretion improves and this indicates that hematuria marks a bettering of the patient. In such cases with increasing blood, casts and albumin decrease. Still the progress may not be in this way, and, instead of this, urine amount decreases because blood in the narrow parts of Henle's loop plugs up the exit for urine and leads to decreased renal excretion. This may be shown by dilatation of the proximal tubules, a back-pressure phenomenon or without dilatation probably a reflex effect on the glomerulus has taken place. Such a change is particularly apt to occur when, in addition, there is some round-cell infiltration about the Henle loops. Finally this late hematuria may be part of an exacerbation of the process and be accompanied by other signs in the urine of a more severe renal lesion.

This explanation of renal hematuria Rochs supports by the histologic study of several cases of acute nephritis. What is of particular, practical importance to the clinician is that often the patients entirely recover even though hematuria persists for several months. In other words, hematuria, especially in the later stages of acute nephritis, when other signs of renal disturbance are slight, is not significant of poor prognosis; at times hematuria is actually an indication of a beginning convalescence that will be complete.

Both of these preceding studies emphasize the need of a thorough understanding of renal circulation in pathological conditions. Altogether not very many good studies of renal vascularity exist, due in large part to the difficulties attached to available methods of injecting renal vessels and studying the material subsequently. Gross⁵² has described some results from a method of injecting the renal vessels with barium sulphate and then studying them by means of the *x*-rays. He has applied this to some pathological conditions and noted interesting disturbances. This method further applied ought to increase our knowledge of renal circulation in various pathological conditions.

⁵² Journal of Medical Research, 1918, xxxiii, 379.

GENITO-URINARY DISEASES.

By CHARLES W. BONNEY, M.D.

SURGICAL DISEASES OF THE KIDNEYS AND BLADDER.

Nephropexy. Since the discussion of operations for floating kidney which appeared in this review a few years ago, nothing of great importance concerning that subject has been published. It is probable that the profession at large now has a better understanding of the limitations of operative treatment in the correction of the condition. Certainly, fewer patients are referred with the request that an operation be done than was formerly the case. Frequently the displaced kidney is only one of several organs which have left their normal place. Moreover, in many cases the symptoms of which the patient complains seem to be out of proportion to the objective manifestations in her case, both with regard to the range of motion that the kidney has and to any urinary disturbances, such as retention of urine within its pelvis, and consequent dilatation of the latter structure. When making physical examinations, the surgeon frequently discovers a movable kidney of which the patient has had no knowledge, and to which none of the symptoms for which she has sought advice can be referred. In cases of this kind, particularly if the patient is of the nervous type, it is better to say nothing to her about her movable kidney. In those cases in which the displaced organ is unmistakably giving rise to trouble, an attempt should be made to restore it to its normal position. It is in such cases that relief from symptoms is to be expected. That the indiscriminate anchoring of displaced kidneys failed to bring the hoped-for relief, can be attested by the experience of anyone who has been enthusiastic enough to operate upon all these patients who have come under his care.

From time to time, variations in the technic of the operation for fixing the kidney are published. An ingenious one that has recently appeared is that of Rawley M. Penick.¹ He uses the Kelly incision, and, after exposing the deep lumbar fascia, he begins the dissection of a ribbon of that structure at the lower angle of the wound, making it about two-thirds of an inch in width. The end is secured with a hemostat and laid aside while the operator proceeds to free the kidney and lift it into the wound in the usual manner. The perirenal fat is stripped to the hilum and the capsule incised and dissected, after which two sutures are inserted into each capsular flap. These sutures are held aside by hemostats while the perirenal fat is gathered by a circumferential large suture, forming in that way a cup-shaped support under the kidney. The ends of this suture are left long and are later attached to

¹ New Orleans Medical and Surgical Journal, April, 1919.

the musculature in the lower part of the wound. The ribbon of fascia is now picked up and a large chromic catgut suture is threaded into the end of it. The author calls this suture the prolongation suture. The strip of fascia is then passed around the lower pole of the kidney, just below the hilum; and a stitch securing it to the capsule of the kidney is introduced anteriorly, to keep it from slipping away. The capsule of the kidney is then secured to the muscle in the usual manner, by passing the sutures previously introduced into it deeply through the muscle plane. Then the so-called prolongation suture, the one previously passed through the strip of fascia, is threaded into a large needle or a carrier and is fixed in the muscles of the back at the most convenient point, fitting snugly around the kidney, and holding it securely while the denuded surface of the organ forms adhesions. The ends of the circumferential large suture in the perirenal fat are now drawn taut, with the result that the loose tissue under the kidney is brought together, and the space obliterated. The wound is then closed by tier sutures.

In support of his operation, the author states that not only is it easily and rapidly done, but that the use of the fascia seems to him to give great security, even under the most severe postoperative strain. He believes that the fascial band may eventually form a stable ligamentous support that would hold the kidney in place in the absence of any other support.

S. H. Harris,² whose paper on renal pain will be discussed later, operates for floating kidney only when there are one or more of the following conditions:

1. Dilatation of the renal pelvis.
2. A positive "pain reproduction" test.³
3. Deficient excretory capacity of the kidney in question for indigo-carmin (or phthalein) or urea.
4. A kidney painful and tender. Here he operates during an attack of pain, or immediately after it, or on a kidney that is constantly painful and tender.

During the operation the fat is removed from the surface of the quadratus lumborum muscle, the bared surface of the kidney is painted with tincture of iodine, the uppermost of three No. 5 plain catgut sutures (one in the upper pole, one in the center of the bared surface one in the lower pole) is passed above the upper border of the eleventh or twelfth rib and the other two sutures are passed through the quadratus lumborum muscle. The anterior layer of the perirenal fascia is sutured to the posterior layer below the kidney. The wound is sutured in layers without drainage.

Edebohls and his followers maintained that chronic appendicitis is a constant complication of movable kidney, being due to a disturbance of circulation in the superior mesenteric vein; and they recommended the removal of the appendix, as a matter of routine, in every case of operation for fixing the kidney. The method which they advocated consists in opening the peritoneum through the lumbar incision. There were some surgeons, who, while denying the genesis of appendicular involve-

² Medical Journal of Australia, January 18, 1919.

³ This is done by injecting the renal pelvis through a ureteral catheter.

ment as set forth by Edebohls, nevertheless believed that the appendix became diseased in practically all cases of floating kidney, and both advised and practised its removal. They were inclined to attribute the supposed trouble to the constipation which is so often associated with displacement of the abdominal viscera. It is now known, however, that mechanical causes play only a minor, if, indeed, any role in the production of appendicitis.

In looking over the work of Edebohls and some of his followers, Rolando,⁴ of Genoa, states that he could not find the record of a single microscopical examination of the appendices that they removed; and, in the light of his own experience, as well as that of some surgeons who took issue with Edebohls, he believes that the latter made the mistake of attributing disease to the appendix, when, in reality, none was present.

Rolando has performed nephropexy twenty-five times, and in only three of his patients were there symptoms that clearly indicated inflammation of the appendix. It would seem that the appendix is less frequently removed by American operators during the performance of a nephropexy than it was some years ago. At least, this is the impression that I have gained from seeing different operators work. Of course, it is easy to take out a normal appendix through an incision in the posterior peritoneum, but it might not be so simple to remove this vestigial organ through such an incision, if it were firmly bound down to the bowel or some of the pelvic structures. Rolando states that he has experienced some difficulty in bringing the cecum into the lumbar wound. If much difficulty should be encountered when this manipulation is undertaken, it might be the part of wisdom to turn the patient over and remove the appendix through the usual abdominal incision, rather than to prolong the lumbar incision onto the anterior abdominal parieties.

Appendicitis, chronic, as well as acute, is an affection which usually presents unmistakable signs, so that there should be little difficulty in determining when the appendix is diseased.

Spontaneous Perirenal Hematoma. Since last years' review, in which perirenal hematoma was discussed and a case reported, two other cases have been published by Karl A. Meyer,⁵ of Chicago, both occurring in the Cook County Hospital. The first case was that of a man, aged twenty-seven years, who was admitted to the medical service with a diagnosis of lumbago. For three weeks he had complained of pain over both kidneys, and stated it was becoming more and more severe all the time. There was no vomiting nor nausea and the pain did not radiate. Neither was there abdominal rigidity, although tenderness was elicited on the left side in the region of the descending colon. He had a leukocytosis of 24,000, and there were many pus cells in the urine. About three weeks after he had been in the hospital, he was seized with sharp pain in the abdomen and right iliac region, after which the right side of his abdomen became rigid. The leukocytes at this time had increased to 78,000. A diagnosis of appendicitis was made, and the patient was transferred to the surgical ward. When the abdomen was opened, a

⁴ Jour. d'Urol., May, 1919.

⁵ Journal of the American Medical Association, May 17, 1919.

large dark retroperitoneal mass was found. This was opened external to the cecum, and about 30 ounces of clotted blood were removed from it. The clots were laminated. Further exploration revealed that a perforation of the kidney had taken place; consequently, the abdominal wound was closed and a lumbar nephrectomy was performed. The patient recovered.

Examination of the kidney showed that an ascending urinary infection had taken place. There were multiple abscesses in the kidneys and also a small tear in the lower pole through which the hemorrhage had taken place into the perirenal tissues.

The second patient was a man, aged forty-two years, a negro, who had complained of pain in the back and abdomen for two months. It came on about one month after he had recovered from an attack of pneumonia. There was tenderness all over the left side of the abdomen. The pain became exacerbated at times and radiated to the genitals, the left thigh and occasionally to the left knee. About three weeks prior to admission, the patient had passed blood with the urine. A diagnosis of hypernephroma was made, and the patient was transferred to the surgical service. When the abdomen was opened, a large retroperitoneal mass was found on the left side. It was incised, and about three liters of blood, the greater part of which was clotted, were removed. The kidney appeared to be softer than normal, but it was not enlarged and no tumor could be found. As the patient was in a very serious condition, the cavity was packed with gauze and the abdomen closed. The patient died the next day.

It is interesting to note that in one of these cases recovery took place. As stated in the review last year, the diagnosis of perirenal hematoma is rarely made, and these two cases would seem to support that opinion. Meyer states that he has been able to find a report of only one case in which a correct diagnosis was made before operation. In the second case he thinks that the lesion in the kidney may have originated from a hemorrhagic infarct which followed the pneumonia.

The Causes of Renal Pain. This subject is discussed by S. H. Harris,⁶ whose paper is based upon the records of 170 cases. Of this number 52 had renal or ureteral calculi, 18 had renal tuberculosis, 32 had suppurative lesions, and 68 had kidney pain without gross infection, the nature of the causative lesion not being immediately apparent. In these 68 cases, various diseases of the abdominal cavity were simulated. Previous futile abdominal operations had been performed in 15 of them.

Exclusive of tuberculosis, stone and gross infections, some form of ureteral obstruction is the cause of renal pain in the vast majority of cases. The diagnosis can, and should, be made in the early stages when correct treatment will result in a practical *restitutio ad integrum*. Stricture of the ureter and renal tumor may be regarded as intrinsic causes of renal pain. For the diagnosis of the former, the cystoscope and ureter catheter may suffice. Often, however, pyelography will be necessary to establish the diagnosis. Pyelography is also of service in

⁶ Medical Journal of Australia, January 18, 1919.

the diagnosis of renal tumor, especially when the tumor is small and growing upward from the upper pole of the kidney.

Strictures of the ureter may be primary or secondary, congenital or acquired. Congenital strictures are extremely rare in the author's experience. Strictures secondary to ureteral calculi are by no means uncommon. The author does not discuss the common strictures associated with renal tuberculosis and other infections.

It is frequently a matter of impossibility in any given case to trace the etiology. Gonorrhea, syphilis and distant focal infections may be considered causative factors.

The pain, intermittent or constant, radiating or fixed, is definitely associated with increased intrapelvic pressure. It may be reproduced by injecting fluid into the renal pelvis or ureter through a ureteral catheter. This test is valuable in diagnosis.

Increased pelvic pressure finally leads to increased pelvic capacity from dilatation of the pelvis or ureter above the stricture. The stricture may exist anywhere along the course of the ureter, but is commonest in the lowest 15 cm. When the stricture is low down, the calices of the kidney tend to be dilated to a greater relative extent than the pelvis.

The excretory capacity of the kidney should always be taken into account in arriving at a diagnosis. The urine on the affected side is sometimes turbid because of the presence of large masses of epithelial cells. Infection finally occurs in these cases and tends to obscure the real source of the trouble. Hence the failure of treatment with vaccines alone.

The strictures are treated as follows: Before infection has occurred they are generally amenable to ureteral dilatation by means of the cystoscope and ureteral catheter. In other cases retrograde dilatation (the pelvis or ureter being opened above the stricture), ureterovesicular transplantation or even plastic operations over the ureter may be required. If these measures fail, resort must be had to nephrectomy. In the case of cystic prolapse of the lower end of the ureter, the ureteral orifice may be slit up through the cystoscope with the high frequency spark or the cystoscopic operating scissors. When infection has supervened, ureteral dilatation and medication of the renal pelvis, often with the aid of a retained catheter, together with the administration of an autogenous vaccine and adequate oral therapy, will sometimes bring quick relief. Too often, however, such cases have passed beyond the stage where conservatism offers any hope of cure, and nephrectomy remains as the sole resort.

Obstruction of the ureter and ureteropelvic junction by aberrant vessels, fascial bands, etc., is a condition which is important and the differentiation of which from ureteral strictures can be made by pyelography in nearly all cases. It is often associated with the next extrinsic cause—movable kidney.

In the vast majority of cases in which it is found, floating kidney has no surgical significance. Abdominal pain is rarely present in this condition unless the renal pelvis is at the same time dilated. During the migration of a mobile kidney, partial strangulation may occur through

torsion of the pedicle and be the cause of violent pain and sometimes hematuria with, or without, dilatation of the renal pelvis.

The pain-reproduction test mentioned above is in such cases positive. When the upper part of the ureter is fixed by inflammatory adhesions, or when anomalous vessels are present, a very slight grade of mobility is apt to lead to kinking of the ureter with resultant retention, dilatation and intermittent hydronephrosis which may go on for years before gross hydronephrosis develops. When, however, such a kidney becomes fixed in its malposition, the ureteral distortion becomes permanent unless relieved by operation, and the progress of the hydronephrotic process is limited only by the degree of collateral circulation and the extent of permeability of the ureteral lumen.

Chronic passive congestion in a kidney whose ureter is kinked and whose pedicle is strangulated may lead to interstitial or parenchymatous changes in the kidney. The kidneys are commonly large, flabby and more or less adherent. The vessels running along the upper part of the ureter into the kidney are commonly varicose and should be tied and divided if found at operation. When both floating kidneys are hydronephrotic, it is best to fix both at one sitting. All causes of ureteral obstruction should be sought for when the floating kidney is operated on. Associated lesions of other organs should be sought for. Splanchnoptosis should be treated by physiotherapeutic means after the operation.

The ureter may also be obstructed by pressure from tumors in the abdomen and pelvis. Sometimes renal pain after operation for the removal of these growths is caused by obstruction of the ureter by ligature. Bladder lesions, such as diverticula, benign and malignant growths may also cause compression of the lower end of the ureter and renal pain. Seminal vesiculitis is a troublesome and often overlooked cause of renal pain (the bladder end of the ureter is near the end of the seminal vesicles). There may too be true vesicular colic indistinguishable from renal colic. Inflammatory conditions of the broad ligaments and of the appendix may involve the ureter by extension. Finally, back pressure due to obstruction of the urethra, congenitally or by stricture, prostatic hypertrophy and median bar formation may cause progressive dilatation of the ureter and kidney, with pain in one or both kidney regions. The pain usually disappears when the ureteral obstruction is removed. A median bar can be removed by the use of Young's prostatic punch passed through the urethra.

Colon Bacillus Infections. Granville MacGown⁷ reports 2 cases which illustrate the manner in which colonic stasis may give rise to infection of the urinary organs. One case was that of a man who complained of prostatic trouble, although he had no residual urine and there was no evidence of any infection of the prostate itself. His urine contained many motile bacilli and many pus cells. Cystoscopic examination showed that the bladder was somewhat inflamed over its base and that there were small polypi in the posterior urethra. The latter were removed and the bladder was irrigated daily, with the result that after

⁷ Surgery, Gynecology and Obstetrics, April, 1919.

a short time the urine cleared up. After treatment had been discontinued, however, the urine again became turbid and was found to contain the same pathologic elements that were present in it on the previous occasion. A repetition of the same treatment again relieved the symptoms. Subsequently the patient suffered from several recurrences. Finally it occurred to MacGowan that the site of the trouble might be in the bowel. An *x*-ray examination showed that there was some obstruction, so it was decided to open the abdomen. At operation, the cecum was found adherent to the abdominal wall and also plicated in such a manner that it had become adherent to both the ascending and transverse portions of the colon. The operation led to a complete cure, the urine becoming clear and remaining so up to the time that the patient was last examined. In this case it seems probable that the stasis of the fecal current may have led to a lymphatic invasion of the kidney.

In the second case the urinary infection was presumed to be due to an old stricture of the urethra, but as the bacilluria persisted after the stricture had been thoroughly dilated, further examination of the patient was made. A median prostatic bar and a small prostatic nodule just within the urethra were found and were removed by a suprapubic operation. As before, however, the bacilluria persisted as well as the bladder symptoms. After irrigations had been thoroughly tried without effect, the ureters were catheterized, with the result that a bilateral colon infection was demonstrated. Then an *x*-ray was taken and stasis of the ascending colon was discovered. At operation the ascending colon was found twisted upon itself and adherent to the transverse portion of the bowel. The appendix was also adherent to the bladder. After some months the patient made a complete recovery.

Operation for Incontinence of Urine. An operation described by Hugh H. Young⁸ for the cure of incontinence of urine caused by injury to the internal and external sphincters is worthy of notice; this condition is not only very troublesome, but, unfortunately, is very refractory to treatment. Young reports 2 cases in which he has obtained a successful result, one of them being that of a patient operated upon ten years ago.

The operation, which is essentially a plastic repair of the vesical outlet, is performed in two stages, the first of which consists in restoring the internal sphincter through a suprapubic incision; and the second, in repairing the triangular ligament and the external sphincter through a perineal wound. After the bladder has been widely opened through the usual suprapubic incision, the mucous membrane over the lateral and posterior surfaces of the vesical outlet is removed with curved scissors, the denudation, if necessary, extending downward into the prostatic urethra, and backward over the trigonum. The object is to expose a considerable area of muscle around the urethral orifice. The area of denudation is shown in Fig. 1. The raw surfaces are sutured together with chromic catgut, the first stitch being placed posteriorly, and including the trigonum, if the latter has been involved in the injury. The other sutures are inserted in the same manner, care being taken to

⁸ Surgery, Gynecology and Obstetrics, January, 1919.

pass them deeply, so that they may pull the urethral surfaces of the internal prostatic orifice together.

The author has found that a special needle holder, which he calls the boomerang, greatly facilitates the passage of these deep sutures. The

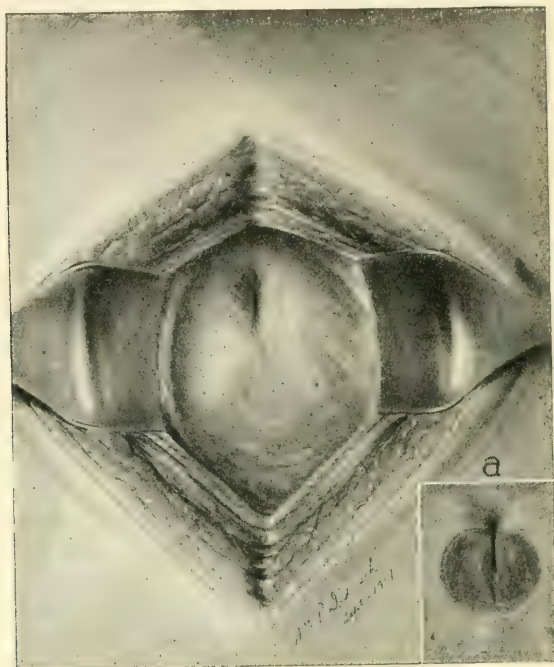


FIG. 43.—View of base of bladder, showing dilated internal vesical sphincter. Inset *a* shows area denuded of mucous membrane, preparatory to suturing. (Young.)

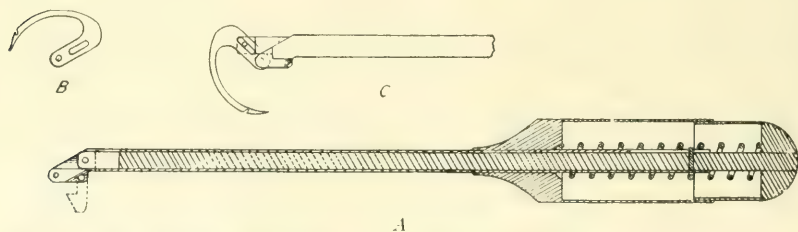


FIG. 44.—*A*, longitudinal section of "boomerang" needle-holder (with needle detached), showing spring in handle which is compressed by the hand to cause the point of the needle to penetrate into the tissues, and return toward the operator, and which, when released, draws the needle back through its tract. *B*, free needle; *C*, method of attachment of needle, which is held in place by means of a small clasp showed opened in *A*. (Young.)

construction of this instrument is shown in Fig. 44. It is so constructed that, by the action of a spring, the point of the needle is pushed back through the tissues toward the operator; hence the term which is applied to it.

Beginning on the left side, the sutures are introduced from within the urethra out through the bladder, and finishing on the right side, the last one passes from the bladder into the urethra. Four or five sutures are required in order to procure a sufficiently firm mass of tissue behind the urethra. A small catheter, which is passed before beginning the introduction of the sutures, is left in place, in order to secure a free exit for the



FIG. 45.—The needle has entered the tissues and returned, pointing toward the operator. Assistant hooks suture in eye of needle. In deep wounds it is necessary to carry the suture down to the needle with a special forceps. (Young.)

urine. It also facilitates the performance of the perineal operation, which consists in excising the scar tissue in the perineum, and, as previously stated, in repairing the external sphincter.

Young considers it advisable to open the urethra, and thinks that, as a rule, it will be well to excise a small segment of it posteriorly, as it will usually be found dilated. The object of this part of the operation is to

secure good approximation of the muscle tissue; and enough dissecting must be done to obtain a good exposure of muscle fibers. It may be necessary to make parallel incisions 1 or 2 cm. lateral to the urethra, so as to liberate external adhesions and thus permit the denuded muscle to be approximated.

In closing the urethra, a continuous suture of chromic catgut is employed, although it is conceivable that in some cases interrupted sutures would serve a better purpose. A second row of sutures is placed so as to include the superjacent muscular layers; and even a third row may be placed, if better approximation can be obtained. Drainage through the catheter is continued for ten days. If infection of the perineum occurs, the external stitches should be removed. The vacuum drainage apparatus devised by E. G. Davis, and previously described in this review, has been found of service in keeping the suprapubic region dry. Various steps of the operation are shown in Figs. 45, 46 and 47.

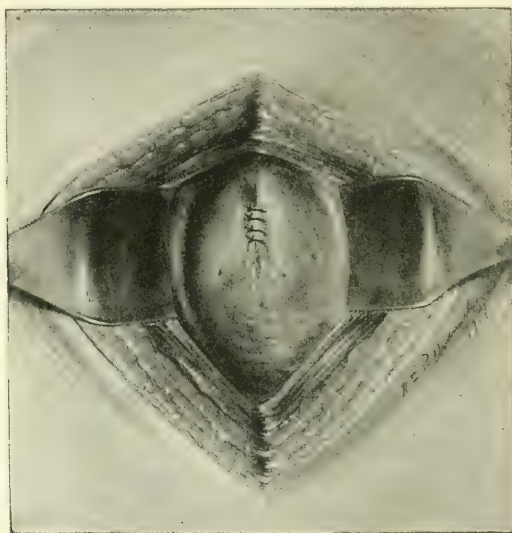


FIG. 46.—Suture line after completion of plastic operation upon internal sphincter. (Young.)

During the third week of convalescence, it is well to pass a small coudé catheter, to prevent closure of the wounds in the region of both the external and the internal sphincter. If difficulty is experienced in passing this instrument, a filiform bougie threaded into the LeFort instrument may be resorted to, although great gentleness is essential in manipulating it. Dilatation up to 22 or 24 French will suffice at first. It may be gradually increased up to 28 French. It should be practised every three or four days, so as to guard against stricture formation. As the patient recovers and gets up and about, he is directed to exercise the sphincter muscles by voluntarily arresting his stream several times during each act of micturition.

In one of Young's cases, incontinence had followed a perineal section, which was performed for frequent urination and pain in the bladder. It did not relieve the pain and, moreover, produced incontinence. The other case was that of a man who, judging from his history, had been subjected to a bungling operation, attempted for the purpose of removing his prostate through the perineum.

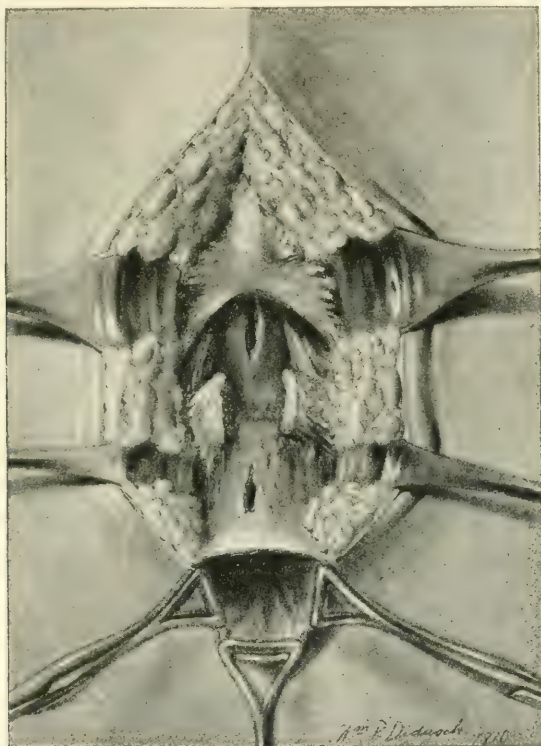


FIG. 47.—Stage in the operation for the radical cure of recto-urethral fistula, as described by Drs. Hugh H. Young and Harvey B. Stone. The rectum and urethra have been separated, and the former dissected free and pulled down, showing a fistulous opening in each. This picture shows the sphincter ani temporarily divided, which procedure was not found necessary in the operation upon Case II. (Young.)

DISEASES OF THE PROSTATE.

Since the publication of last year's Review, there have been few notable contributions to the surgery of the prostate. A number of surgeons have reported series of prostatectomies, which, however, give no new information concerning the mortality-rate of the operation. A better understanding of the importance of preparatory and after-treatment has become general during the last few years and there is scarcely an author today who does not lay stress upon them. The methods in vogue have

been fully described in this Review and do not require additional discussion at the present writing.

With regard to technic, a paper by A. J. Ochsner,⁹ of Chicago, may be cited, although it is not likely that any considerable number of surgeons will adopt the method because they are so well satisfied with the suprapubic operation. Ochsner believes that his operation combines the advantages of the suprapubic and perineal methods. With the patient in the lithotomy position, an incision corresponding to the old lateral lithotomy incision is made in the perineum, extending from a point half way between the scrotum and anus to a point half way between the left tuberosity of the ischium and the anus. Through this incision the membranous urethra is opened and the point of a lithotomy knife is passed into it and made to enter the bladder, together with the tip of a grooved sound previously passed into the urethra. When the sound is being pushed into the bladder, care is taken to carry it along the pubic bone so as to prevent the knife from cutting into the rectum. Through the vesical opening thus made, the operator's finger is passed, the sound serving as a guide. Ochsner states that the finger will be in the same position that it would be if a suprapubic opening had been made. It is in this respect that he believes the method to be superior to other perineal methods of operation, because, beginning from above and entering the capsule of the prostate gland through the urethra, enucleation of the prostate can be carried out in the same manner as if the bladder were entered through a suprapubic incision. If bands or adhesions are encountered, they can be severed with a pair of blunt curved scissors. When the prostate has been entirely freed from its capsule and from its attachments to the urethra, it is drawn out into the perineal incision with Young's forceps. Its bed is then carefully gone over with the finger to determine if any portions of prostatic tissue have been left behind.

The index finger of the left hand is then introduced into the neck of the bladder and the capsule of the prostate is caught by means of fine-toothed forceps, one being applied to the right and one to the left. Then a drain consisting of an inner tube 1 cm. in diameter and covered in its middle portion by a second tube just large enough to slip over it, is passed into the wound, the inner one extending into the bladder and the outer one lying in the bed from which the prostate was enucleated. Then gauze is packed around the outer tube, filling the capsule. The drain is fastened to the skin by means of silkworm-gut sutures. At the end of forty-eight hours, both gauze and tube are removed.

Ochsner states that this operation can usually be performed in less than fifteen minutes, that the shock is slight, and the amount of traumatism not excessive. He states that older surgeons, who performed lateral perineal lithotomies before suprapubic operation came into vogue, will remember how easy it was to remove large stones through a lateral perineal incision and how comfortable the patients were after the operation. His adaptation of the method for enucleation of the prostate,

⁹ Surgery, Gynecology and Obstetrics, July, 1919.

so he believes, offers equal advantages in that a satisfactory enucleation through the bladder can be effected, good drainage secured and hemorrhage controlled.

Soresi¹⁰ describes a modified two-stage procedure, which has for one of its chief objects the prevention of infection of the perivesical tissues. Instead of suturing the bladder to the skin just before opening it, as some surgeons have done, Soresi makes this suture as a preliminary operation, thereby doing away with any contamination by the bladder contents until adhesions have taken place between the viscus and its surrounding tissues.

Under local anesthesia, the bladder is exposed in the usual manner, and then secured to the skin by a series of special stitches, which enter at the edge of the skin incision and go through the outer layers of the bladder. The first stitch secures the upper portion to the upper angle of the incision. The two ends are held in a hemostat by an assistant, and then the lower portion of the bladder is secured by another stitch to the lower angle of the skin incision, the two ends of this suture being also held in a hemostat. While the assistant holds these hemostats, a number of intermediate sutures are placed in the same manner as the two previous ones, so as to bring the lateral margins of the exposed bladder close to the edges of the skin. The sutures are tied in the manner shown in the accompany illustrations. (Figs. 48 and 49).

Within a few days, adhesions begin to form between the skin edge and the bladder, whereupon the bladder may be opened and, if deemed advisable, the prostate may be removed. If necessary, however, drainage may be carried out for a time before enucleating the gland, and there will be no danger of infection of the space of Retzius.

Soresi also describes an apparatus for the control of hemorrhage. (Fig. 50). It consists of a pear-shaped rubber bag, which is filled with metallic mercury after it has been placed in the bed from which the prostate was enucleated. A tube is attached to each end of the bag. Tube A, extending from the tapering extremity, is tied to a catheter introduced through the urethra, and then pulled out into the urethra until the bag itself rests in the area formerly occupied by the prostate. Then tube A is tied, and the mercury is poured into the bag through tube B, which projects from the suprapubic wound. Finally, a rubber drainage-tube is placed around tube B and secured by tying the ends of the threads that were previously used to fasten the bladder to the skin. The accompanying illustrations show the manner in which the bag is placed and retained. Soresi maintains that the even, continuous pressure exerted by this apparatus guards better against the occurrence of hemorrhage than does the air-distended bag.

Other points in technic are brought out by G. Kolischer,¹¹ of Chicago, who advises that both the upper and the lower extremities be constricted with an elastic band for twenty minutes before the administration of the anesthetic is begun, the object being to produce venous stasis. The elastic bandage is placed around the thigh, as near the inguinal fold as

¹⁰ New York Medical Journal, July 12, 1919.

¹¹ Texas Medical Journal and Urologic and Cutaneous Review, August, 1919.

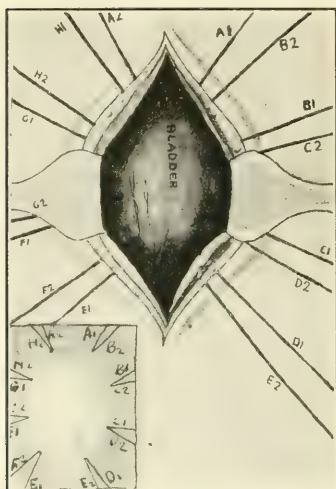


FIG. 48.—A, view of exposed bladder with all the stitches in place ready to be tied. B, shows how ends of thread must be tied to each other. A1 is tied with B2; B1 with C2; C1 with D2; D1 with E2; E1 with F2; F1 with G2; G1 with H2; H1 with A2. (Soresi.)

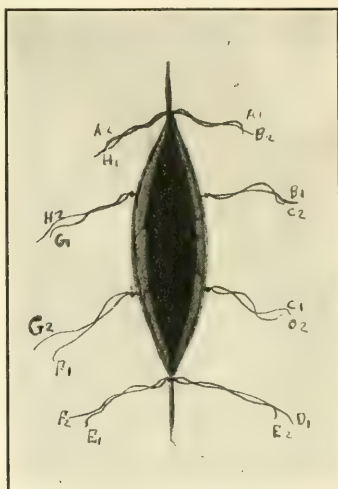


FIG. 49.—Bladder secured to the skin, with upper and lower angle of skin incision closed. H1 and A2 are tied with A1 and B2; E1 and F2 are tied with D1 and E2.



FIG. 50.—Bag C of soft rubber, with tube A for the urethra and tube B for the introduction of mercury. (Soresi.)

possible, and upon the arm, well up toward the axilla. By this procedure the author believes that about one-third of the blood supply of the body is confined to the limbs. This lessens the bleeding during the operation; and he thinks, also, that when the constriction is removed after the operation is completed, the rush of blood from the limbs helps the patient to recover rapidly from the anesthetic.

Before the operation is begun, a Barnes bag is introduced into the rectum, and is distended with 100 c.c. of water. This pushes the trigonum up, and, Kolischer maintains, makes the prostate more readily accessible. The bladder is emptied by means of a catheter, and 300 c.c. of 2 per cent. protargol solution is injected into it. After the skin incision has been made, a mass of subcutaneous fat the size of a walnut is dissected from the subcutaneous tissue, and is later transplanted into the bed of the prostate, for the purpose of controlling hemorrhage. After the bladder has been opened, retractors are inserted, and traction is made straight up and down; that is, in the occipitocaudal direction, which the author believes gives a much more satisfactory exposure than does lateral traction on the margin of the vesical wound.

The important landmarks that he seeks are the opening of the urethra and the circular groove around the base of the enlarged prostate. Anywhere between these two landmarks the mucous membrane is incised with a pointed knife for a distance of approximately two inches. This incision is carried into the substance of the prostate itself, the latter being of a lighter color than the overlying mucosa. Kolischer does not care to insert his fingers into the rectum to facilitate enucleation of the gland. When the tumor has been delivered, it is separated from the urethra by cutting through the latter. Hemorrhage is temporarily controlled by means of a gauze pack. Then the mass of fat previously taken from the subcutaneous layer of the abdominal wall is substituted for it. The transplantation is done as follows: A catgut suture is first passed through the right edge of the bladder wound. Then the needle is brought outside of the abdomen and made to perforate the lump of fat, after which both needle and suture are again carried into the bladder, perforating from within the outer lip of the vesical wound, and then being brought again to the surface. By pulling on the ends of this suture the fat is carried into the cavity, out of which the packing is taken, so that the fat can be pressed well down to the bottom of the space, and there held by tying the suture. In some cases it has been found necessary to place another gauze pack, in order to control the hemorrhage completely. Kolischer drains the bladder with a rubber tube of a half-inch diameter, which he fastens to the upper angle of the wound by means of a purse-string suture. A rubber drain is also inserted into the space of Retzius. After the patient has been placed in bed, a glass tube, bent at a right angle, is inserted into the free end of the vesical drainage tube; and to the distal end of the glass connector, a long piece of rubber tubing is attached, the free end of which is passed into a glass bottle containing some antiseptic fluid. The suction apparatus is not favored, because the author believes that it may loosen blood clots, and thus possibly cause a secondary hemorrhage.

A Combined Suprapubic and Perineal Operation for Removal of the Carcinomatous Prostate is described by McKillop.¹² The bladder is exposed through the ordinary suprapubic incision, thoroughly freed from the pubic arch and its lateral attachments and then pushed down as low as possible. The space of Retzius is packed firmly with gauze and retention sutures are carried through the margins of the wound and tied so as to hold the gauze in place. Then the patient is placed in the lithotomy position and the perineum is entered through the usual curved prerectal incision. Dissection is continued until the prostate is thoroughly exposed and is also carried lateral to the gland. The capsule, however, must not be opened. When a good exposure has been secured, counter-pressure is made from above by pushing downward upon the gauze in the suprapubic wound. This brings the gland to a very low level. The puboprostatic and lateral ligaments of the bladder are cut through and the gland is separated by blunt dissection from the base of the bladder. When the limit of separation by blunt dissection has been reached, the bladder wall is cut through by means of a circular incision and the vasa deferentia and the membranous urethra are also sectioned. After this has been done the prostate, together with its capsule, can be completely removed. A catheter, which was previously passed into the bladder through the incision, is left *in situ* while the urethra is divided, the two being cut through together. A large soft rubber catheter is introduced through the urethra and carried into the cavity of the bladder. The vesical wound is then sewed around with catgut sutures, care being taken to clamp and ligate all bleeding points. When this has been accomplished, a gauze drain in a split tube is carried down to the base of the bladder and iodoform gauze packed around it. Finally, the lateral portions of the perineal wound are closed with silkworm-gut sutures, the gauze sponge removed from the suprapubic opening, a small drain tube introduced and the remainder of the wound closed in the usual manner.

The author states that patients subjected to this operation suffer with a variable degree of incontinence, but, in view of the fact that it is done for malignant disease, he feels that this unpleasant sequel should not militate against its performance.

RADIUM IN THE TREATMENT OF CARCINOMA. In last year's review the treatment of carcinoma of the bladder and prostate was discussed, and a description of some special instruments used for its application was given. In a recent contribution to the subject, Marion¹³ has described a simple, though unique, method of applying this substance to the prostate. Being impressed with the idea that applications made through the urethra by special sounds would act only upon a small portion of the growth, and having little confidence in applications made through the rectum, it occurred to him that it would be better to introduce the radium directly into the substance of the gland by puncture than to incise the perineum freely or to introduce it through a vesical incision. Furthermore, he states that perineal incisions have been followed by fistula.

¹² Medical Journal of Australia, January 18, 1919.

¹³ Jour. d'Urologie, August, 1918.

Consequently, he resorted to the use of a large trocar, such as is ordinarily employed for tapping a hydrocele, puncturing the perineum to one side of the median line, and carrying the tip of the trocar directly into the substance of the prostate. A finger passed into the rectum serves as a guide. The trocar is withdrawn, and the tube of radium is passed through the cannula. When it reaches the end of the cannula, it is held in place by means of a tunnelled sound, while the cannula itself is withdrawn. Then a similar puncture is made upon the opposite side of the perineum, and another tube of radium introduced in the same manner. The tubes are withdrawn by means of a silver wire, which is attached to them. Marion states that the puncture wounds heal at the end of forty-eight hours after the withdrawal of the radium, and that the patients are able to be up and about at the expiration of that time.

DISEASES OF THE PENIS AND URETHRA.

Genital Sores. Herpes progenitalis is discussed by Aronstam,¹⁴ of Detroit, who takes up its etiology, symptomatology, pathology and treatment in a very thorough manner. He includes under the term herpetic lesions which involve the groin, the lower third of the hypogastric area, the perineal region to within a half inch of the anus, the ischiorectal space and the lower gluteal fold.

With regard to causation, he recognizes two chief varieties, one due to a peripheral neuritis, and the other due to vasomotor paralysis, subjective symptoms being much more pronounced in the first form than in the second. As underlying causes responsible for both types, he makes the following enumeration: hereditary neurosis; debilitating diseases, such as the acute exanthemata and other acute infections; autotoxemia, which is especially likely to be caused by gastro-intestinal disturbances; drug intoxication; disturbances of metabolism, such as diabetes, lithemia and the symptom-complex included under the term "rheumatic diathesis;" senile degeneration of the tissues involving the cutaneous nerves, and certain neuroses and psychoses that develop during adolescence. In addition to these general causative factors, certain local conditions, such as a tight foreskin or any irritation applied to the parts, must be considered as responsible for the development of the lesion in some patients. Thus, contact with vaginal discharges containing the staphylococcus, as well as irritating postmenstrual secretions, frequently result in an outcrop of vesicles. Reflex irritation, such as may be caused by seat-worms or chronic disease of the prostate, is another factor; and, finally, attention is called to that group of cases in which no assignable cause can be found, and which the author, in common with other observers, is inclined to attribute to a special susceptibility on the part of the patients. The action of some specific irritating micro-organism is likewise mentioned. It is quite possible that if more thorough investigations were carried out on the group of patients who seem

¹⁴ Medical Review of Reviews, January, 1919.

periodically subject to this form of genital eruption, some one of the systemic causes above enumerated might be found.

This affection is characterized objectively by multiple vesicles arranged in circles or semicircles and confined to areas supplied by definite peripheral nerves, as evidenced by the presence of distinct groups. They are not indurated at the base, and remain dry until the vesicles have ruptured, either spontaneously or as the result of pressure. As the contents are absorbed, the surface of the vesicles become encrusted. This characteristic serves to differentiate them from chancroids, and the absence of induration at the base also makes it easy to distinguish them from multiple syphilitic lesions. Within a week or ten days the vesicles undergo resolution, leaving pinkish spots to mark the site of their location. The latter soon fade without leaving any scar. An important subjective symptom is the almost invariable association of itching and pain, these symptoms being present at some time during the evolution of the lesions.

Microscopic studies have revealed an inflammation of the peripheral nerve-endings supplying the diseased area, and also a localized vasomotor paralysis; the latter condition usually following the former. The epineurium is inflamed, so that the neural cells are impinged upon, with the result that a decrease in conductive power is brought about. Consequently, trophic disturbance develop in the tunic of the capillaries of the affected areas, causing a transudation of serum to take place between the true skin and the epidermis. In this manner the vesicles are formed. The author states that French dermatologists have found pigment crystals resembling indican within the epineural sheath. These are probably due to a decomposition of hemoglobin.

Treatment, which should be directed to the removal of the underlying causes, may be either general or local, or both. Except in those patients who seem to have a special predisposition to attacks, the prospect of bringing about a permanent cure is favorable. Great stress is placed by Aronstam upon proper regulation of the diet. The starches should be restricted, as should likewise stimulating food, such as spices and highly seasoned sauces of all kinds, as well as all varieties of shellfish. Tea, coffee, and fermented and spirituous drinks are interdicted. In lithemic or gouty patients elimination should be increased by the use of such drugs as potassium acetate, the benzoates and colchicum. The salicylates, also, have proved beneficial in the author's experience; and he speaks well of the action of the *Bacillus bulgaricus* in cases in which there are manifestations of intestinal toxemia.

Local treatment consists in circumcising patients who have a long or tight foreskin, treating any chronic discharges that may be present, and applying one of the impalpable powders, such as lycopodium or stearate of zinc, to relieve the irritation of the glans. Strict cleanliness is, of course, essential. Among the cleansing solutions which the author recommends, are those made of boric acid and baborate of sodium. The latter is one that the reviewer has used with great satisfaction for a dozen years. Dusting powders of bismuth subnitrate or subgallate, aristol or euophen, have likewise proved efficacious. Aronstam gives formulas combining these drugs. It is probable, however, that just as

good an effect can be obtained by using any one of them alone. Max Joseph used to speak very highly of the subgallate of bismuth. I think, however, that I have had as good results from aristol as from any application that I have employed. Aronstam states that if the parts be slightly moistened with a little glycerin before the dusting powder is applied, the latter will remain in contact with the lesions longer than if it is dusted on when the parts are dry. In cases in which the lesions are on the glans, they may be protected from friction against the prepuce by interposing a little piece of soft, sterile gauze between the two surfaces. The gauze is folded and slit in the center. Then the glans penis is drawn through the opening, and the prepuce pulled over it. Vesicles situated between the scrotum and the thigh are best protected by fastening a piece of gauze in that region. Applications of boric acid solution or weak lysol are recommended when ruptured vesicles have become infected.

A timely warning is sounded against the practice of cauterizing such ulcers or of applying a strong antiseptic solution to them. Such measures not only irritate these sores, but, if resorted to frequently, may cause them to become indurated, and thus lead to a mistaken diagnosis of a syphilitic infection.

The author states that he has seen a number of cases in which the mucous membrane of the external meatus has been the seat of herpetic vesicles. These cases, however, were associated with similar lesions on the prepuce or on the dorsum of the penis. A number of cases are reported which illustrate the different causative factors of this common and troublesome infection.

A cognate subject, namely, BALANO-PREPUTIAL INTERTRIGO, has been discussed by Douglas W. Montgomery,¹⁵ of San Francisco, who reports a case due to streptococcus infection, and who summarizes the causes of the lesions. Among the unusual etiological factors are the *oidium albicans*, a fusiform bacterium resembling that of Vincent's angina, and a spirochete that is probably identical with one found in the lesions of gangrenous stomatitis. He also states that he has seen the lesion develop in patients who were taking iodine internally and using calomel as a dusting powder, excretion of the iodine through the skin and mucous membrane having produced an iodide of mercury by combining with the calomel. Scabies, the erosive syphilides, irritating urethral discharges either specific or non-specific, and irritation due to an accumulation of smegma, are also cited as etiological factors.

With regard to treatment, simple applications, either in the form of weak antiseptic lotions or dusting powders, will usually effect a cure. Montgomery recommends a boric acid lotion and a calomel and zinc oxide dusting powder. He has also found a weak mercurial ointment, such as calomel or the yellow oxide to be efficacious.

Several cases of another rare form of ulceration of the external genitals have been reported by Burnier,¹⁶ of Paris; namely, the so-called GONORRHEAL CHANCRE—that is, an ulceration due to the gonococcus, having the appearance of a true chancre, and either indurated or soft.

¹⁵ Urologie and Cutaneous Review, February, 1919.

¹⁶ Ibid., March, 1919.

These lesions occur in both sexes. In the male the usual location is the glans, either along the corona or close to the meatus. They vary considerably in shape and size, as well as in the depth to which they ulcerate. Thus, they may be oval or circular, or quite irregular; and in the same patient there may be both superficial and deep sores. The lymphatics of the penis may be involved, and in some cases there may be a marked enlargement of the inguinal lymph nodes. Induration of the margins of the sores is not uncommon, and there may also be considerable edema of the prepuce. In some cases the sores have assumed phagedenic characteristics.

In the female the lesions are usually multiple, occurring near the urethral opening, close to the orifices of Bartholin's glands, upon the fourchette and upon the cervix. Some have also been found in the region of the anus. They are usually round, although, as in the male, the serpiginous form may occur. Edema of the labia majora has occasionally been noted as a complication.

While in the majority of cases there is an associated urethral discharge, this symptom may not be present, as shown by some of the cases that the author mentions. In the latter variety, the diagnosis can be made only by means of microscopic examination, the secretion from the sore showing the gonococcus. Treatment consists in the application of silver nitrate, zinc chloride, or a strong solution of potassium permanganate. While these measures are usually sufficient, Burnier states that in some cases it becomes necessary to curette the sores and apply the actual cautery. He reports 2 interesting cases in which there was mixed infection. In 1, the bacillus of Ducrey was associated with the gonococcus while in the other the spirocheta was demonstrated.

Any review of genital sores would be incomplete without reference to Klauder's¹⁷ excellent paper, based upon an analysis of 115 cases of PRIMARY SYPHILITIC LESIONS. His paper is especially noteworthy in that he calls attention to some of the shortcomings of laboratory diagnosis. Thus, he points out that the dark field examination, though of great value in cases in which the sore has become indurated, will often fail to give positive results because chemicals have been applied before the patient comes under observation. He discusses the effect of various spirocheticidal drugs. He states that after a single application of silver nitrate the spirochetes become very scanty and that the dark field examination almost always becomes negative. In a similar manner two daily applications of calomel cause them to disappear. So too, a secondary infection with the pyogenic organisms may result in a disappearance of all spirochetes from the surface of the chancre. In view of these circumstances, the author advises that when local applications have been made, the serum from the deepest part of the ulcer should always be taken for examination instead of the scrapings from the surface. He has found that when the dark field examination is negative, the application of alcohol, by dilating the lymphatics and thus bringing the spirochetes to the surface may be of value. In 25.1 per cent. of his cases it was

¹⁷ Journal of the American Medical Association, March 8, 1919.

impossible to resort to the dark field examination because the ulcer was either concealed beneath an adherent or inflamed foreskin or because its surface had become healed at the time the patient was seen. In only 57 per cent. of the cases was it possible to demonstrate the spirocheta, the low percentage being attributed to the fact that in 66 per cent. of the cases local treatment had been given before the patients came under the author's observation. The average duration of these 115 chancres was 33.4 per cent. days.

The characteristics of specific sores are described in detail. In color, the base of the ulcer is compared to that of raw beef. There is a considerable amount of serous secretion present, which is a diagnostic sign of importance. Unless secondary pyogenic infection occurs, there is no formation of membrane, although the secretion may dry and form a crust over the sore. The margin is usually flat and sharply demarcated, but some lesions present an elevated border. The absence of induration does not mean that the ulcer is non-specific, nor should the presence of more than one lesion be construed as meaning that the sores are simple ulcers. This is an important point not sufficiently well understood. In Klauder's cases, 17.3 per cent. of the patients presented multiple lesions. Non-inflammatory edema is a valuable, though not constantly present, diagnostic sign. It may involve the whole foreskin or be limited to the immediate neighborhood of the chancre. The skin is of a dull, livid-red or bluish tint.

The differential diagnosis of mixed infection is also discussed, not only chancroid but also erosive and gangrenous balanitis being considered. The spirocheta balanitidis is coarser and moves more rapidly than the spirocheta pallida and can be readily differentiated from the latter by a competent bacteriologist. Klauder's cases were observed in military service at Camp Upton.

TROPICAL ULCER, an ulcerative lesion of the skin most freely affecting the lower extremities, is characterized by the presence of the bacillus of Vincent, the spirocheta of Schaudinn, and numerous associated pyogenic organisms. Cases are observed at all seasons of the year, but especially during the hot and rainy seasons, at which time it may assume the characteristics of a mild epidemic disease, the increase in its frequency being due, no doubt, to more frequent bathing in contaminated water. Diminished resistance also predisposes to it, for it has been noticed that an unusually large number of cases occur during periods of famine.

Aldo Mei¹⁸ states that from August, 1917, to August, 1918, he treated more than 300 cases of this affection in one of the Italian colonies in Africa. He points out that the lesions may appear on the genitals either as a primary infection or become secondarily implanted upon venereal ulcers, particularly syphilitic sores. He reports cases of both kinds. The first case to which he directs attention was that of an Arab, aged thirty-five years, a gardener, who first came under observation June 25, 1918. About two months before he had noticed a small ulceration on the body of the penis about midway between the glans and its

¹⁸ Giornale Italiano Delle Malattie Veneree E Della Pelle, March 9, 1919.

attachment to the pubes. This sore developed a few days after he had had a suspicious intercourse. It remained stationary for about a month. While riding horseback, he was thrown into a ditch, his penis being bruised by the saddle and contaminated with mud and dirty water. From that time the ulcer began to increase in size. The author states that when he first saw the patient it was as large as a half dollar. There were no signs of syphilis present. There was a secondary ulcer on the scrotum where that part came in contact with the ulceration on the under surface of the penis. Examination of the secretions from the two ulcers showed an enormous quantity of organisms of true tropical ulcer; namely, the bacillus of Vincent and the spirocheta of Schaudinn, together with groups of small cocci resembling the staphylococcus.

Another case is reported in which these elements were also found together with the treponema pallidum, the diagnosis being tropical ulcer implanted upon the initial lesion of syphilis. In this case the secondary contamination was evidently due to the fact that the patient, also a gardener, had frequently bathed in an irrigating tank in his garden, with the result that the secondary infection became implanted upon his primary syphilitic lesion.

A third case which is of interest is one in which a tropical ulcer developed in the scar of a gumma. The author states that, among the indigenous population, phagedenic ulcerations upon the genital organs are frequent, and that they are characterized by great rapidity of extent, frequently assuming a serpiginous type. Most commonly they are due to chancroids, occasionally to chancres and rarely to ulcerating gummas. In a few cases like those here reported, careful microscopic examinations of the secretions will reveal one or both elements of true tropical ulcer. With regard to absence of one of these organisms, the author states that the same thing often occurs in tropical ulcer of the extremities, even in cases in which the lesions are so typical that no doubt as to their nature can possibly be entertained. He states also that these genital sores have nothing in common with the so-called ulcerating granuloma of the pudenda, which was discussed in this review two years ago. Implanted upon a syphilitic ulcer the microorganisms of tropical ulcer predispose to rapid destruction of tissue, as shown by one of the cases above cited.

With regard to treatment, the author has found that the best results are obtained with iodoform. After the sore has been thoroughly dried, the finely powdered drug is applied and then a dry sterile dressing is put on. This treatment is given every day. Immediate improvement is the rule. Usually in one week the bacillus of Vincent and the spirocheta have nearly disappeared and the base of the ulceration has become covered with healthy granulations. Owing to the extent of these lesions, however, it was necessary to keep some of the patients in the hospital for several weeks before complete healing could be secured.

With regard to the TREATMENT OF CHANCROID, a paper by Petges, Gratiot and Cottu¹⁹ is of interest. These authors report gratifying results from the use of *iodine vapor*, which they employed for ten months

¹⁹ Jour. de méd. de Bordeaux, September, 1918.

at the Dermatological and Venereal Center at Jouarre, during which time they treated 236 soldiers, 156 of whom were affected with simple chancroids and the remaining 80 of whom had chancroids complicated with buboes. In all the latter cases the buboes had either opened spontaneously or had been opened surgically before the soldiers were admitted to the authors' service. They consider the treatment applicable to all forms of chancroidal infection, including those of the meatus, those complicated by phimosis, and those in which there is an associated syphilitic infection.

Although there are many excellent apparatus on the market for the production of iodine vapors and their application to diseased tissue, the authors improvised a simple one made out of a glass buret fitted with a rubber stopper or cork, through which two holes are made for the passage of two elbowed glass tubes, one of which is tapered for the exit of the vapor. The tube which conducts the air is passed well down toward the bottom of the flask, in order to prevent cooling of the vapor as it enters the tube through which it finds its exit from the bottle. An alcohol lamp and a thermocautery bulb complete the apparatus. About a tablespoonful of iodoform is put into the bottle and heated. After a few seconds, the iodine vapor escapes through the tapering bulb, which has been previously warmed in order to prevent condensation of the iodine. Metallic iodine itself can be used, instead of iodoform; but in the army, the latter was more easily obtained.

One treatment every two days seemed to be sufficient. Before the application of the vapor, the lesions were freed from secretions and dried with gauze. When the sores lose their specific characteristics and assume a healthy red color, it is better to discontinue this treatment, substituting for it some simple application, such as solution of silver nitrate, 1 to 40, which will hasten cicatrization. One must be careful not to produce iodine burns on the contiguous healthy parts. In view of such a possibility, the authors administer all the treatments themselves, not allowing nurses or orderlies to apply the vapor. They express the opinion that chancroids subjected to this treatment early in their development will be cured in from eight to ten days. In their own cases, however, in which the patients did not come under treatment until they had been ill for some time, fifteen days was the average time required. A month was necessary to heal the buboes. It is interesting to note that in not a single case treated by this method did buboes develop, those that the authors saw having been present when the patients were admitted to their service.

Fontan's method of treating chancroidal buboes has received favorable mention by several military surgeons, among whom may be mentioned Dubreuilh and Mallein.²⁰ This method, it will be remembered, consists in injecting a suspension of iodoform in vaseline into the bubo after its contents have been evacuated through a small puncture. Although in use for a number of years, little attention has been given to it until recently by writers in the medical journals.

²⁰ Medical Press,¹ London, June 25, 1919.

The above-mentioned authors have treated 121 cases in military service, and submit a report upon the results obtained. In all but 15 cases they were well satisfied with the method. Of this number, there were 4 in which fistulæ formed, and 8 in which ulceration of the skin developed. In the remaining 3, the skin was already on the point of giving way when the patients were admitted to the hospital. In the 106 cases reported as satisfactory, cure was obtained in from four to six days. The authors consider the procedure to be contra-indicated when the skin over the bubo has become so badly involved that it is on the point of giving way. The method is also inapplicable to cases in which suppuration has not freely taken place. When the bubo presents unquestionable signs of fluctuation, the time has arrived to puncture and drain it, and then distend it with the iodoform suspension. It is necessary to squeeze out all the pus before putting in the medicine. When the last few drops become blood-stained, the injection may be made. The authors use an ordinary glass urethral syringe, and thoroughly distend the abscess cavity. They prefer to cool the iodoform vaseline by dipping the syringe containing it into cold water, thereby preventing it from running out after it is injected. (In the Jefferson Hospital Clinic the late Prof. Horwitz was accustomed to apply an ice-bag to the groin immediately after the injection was made—a procedure that worked well.) A cotton-wool dressing, fastened down with collodion and held in place by a spica bandage, is applied. It is kept on for forty-eight hours, after which the cavity is emptied of vaseline and a fresh collodion and cotton dressing is applied. Ten or 15 per cent. iodoform gave equally good results in the practice of the authors. Some of the patients were treated in the outdoor department and allowed to walk about, although it is considered better for them to be kept in bed for forty-eight hours. In conclusion, the authors state that they are not familiar with any method of treatment that can compete with Fontan's method in hastening recovery and reducing the sojourn of bubo patients in the hospital.

Gougerat and Clara²¹ call attention to peculiar lesions of the genitals caused by poisonous gas, which may either be mistaken for venereal sores or serve to conceal syphilitic infection. During the last months of the war, they had occasion to observe a considerable number of such cases. They state that it was not uncommon to see soldiers who had been burned upon the genitals only, although in many cases there were associated burns on the thighs and other parts of the body. Naturally, it was in the former class of cases that difficulties in diagnosis would be most likely to arise. The inflammation accompanying burns of the gland and the coronary sulcus almost always resulted in phimosis or paraphimosis, which was frequently associated with great edema. When phimosis was produced, there was often a secondary enlargement of the inguinal lymph nodes, which would naturally lead one to assume that the inflammation was specific, and not simple. One case is mentioned in which a burn very much resembled an ecchymatous chancre. Cases

²¹ *Annales des maladies vénériennes*, May, 1919.

are also reported in which syphilitic infection contracted prior to the time at which the soldiers were burned with gas developed in the burned areas.

The authors classify gas burns under three heads: (1) those presenting marked erythema with some edema, which may eventually undergo cicatrization, or which may heal without cicatrization; (2) vesicles and bullæ, which often reveal either superficial or deep ulcerations; (3) gangrenous sores associated with great swelling, which heals slowly and leaves deep scars.

Now that the war is over, the practical interest of these cases will not be so great as it was during hostilities; but, nevertheless, it is well to bear their occurrence in mind, especially from the standpoint of industrial surgery and the compensation laws which are operative in some of the States.

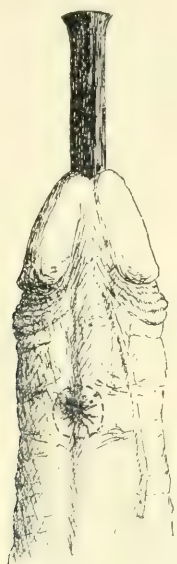


FIG. 51

The Repair of Urethral Defects. Several years ago, in this review, the use of segments of veins for repairing urethral defects was discussed, the work of Tanton receiving special notice. That the results obtained were not always satisfactory was mentioned at that time. In a recent contribution by Legueu,²² of Paris, 3 cases are reported in which grafts of vaginal mucous membrane have been used for filling in the break in the continuity of the urethral canal. It is interesting to note that this method was also first practised by Tanton, who, at the time, was Legueu's assistant.

Certain preliminary conditions are considered essential to the successful employment of vaginal grafts. In the first place, Legueu states that

²² Journal of Urology, October, 1918.

resection of the strictured portion of the urethra must be preceded by a temporary urethrostomy, in which both ends of the resected or wounded urethra are attached to the skin. In acute traumatic cases it is necessary to wait several months before applying the graft. During this time

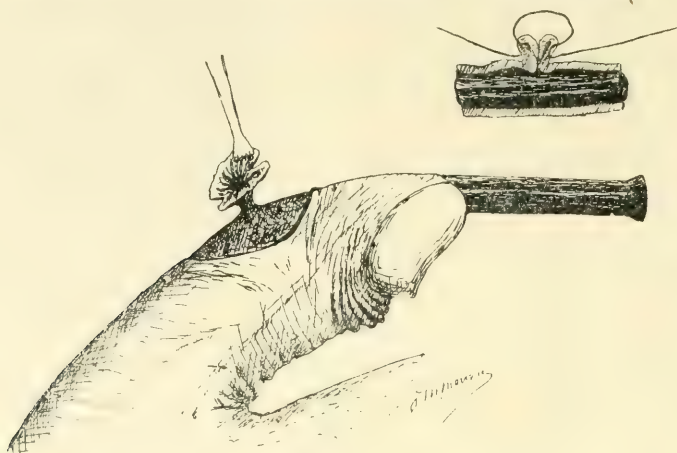


FIG. 52

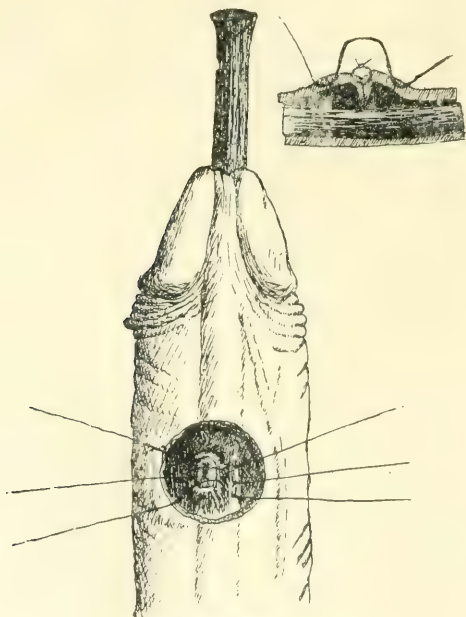


FIG. 53

the infection will have subsided and the tissues have become healthy. Furthermore, the two openings must be dilated, in order to prevent contraction at one or both sites of union between the graft and the urethra.

The second requisite is a suprapubic cystostomy, which may be done before the urethrostomy is performed. The author warns against draining the bladder through the perineum, for the reason that it may leave an infected wound near the posterior attachment of the transplanted tissue.

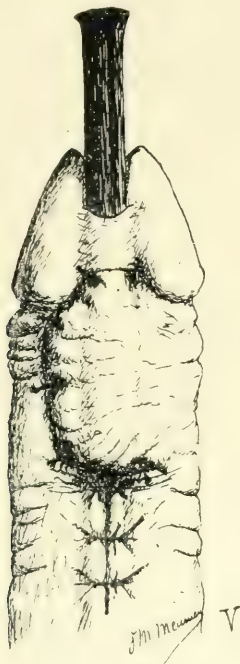


FIG. 54

The third preliminary stage is the tunnelling of the tissues through which the graft is to be passed, and is one which the author considers essential, regardless of the nature of the tissue which is to be transplanted. He states that in several cases in which he has used segments of veins, failure resulted because this desideratum was neglected, the grafts having been placed just beneath the skin.

For tunnelling a special trocar provided with cannulae of different length and caliber is used. One which is appropriate to the individual case is made to enter the anterior urethrostomy opening, and then, after having been forced through the tissues, is made to protrude through the posterior opening. This order of entrance and exit may be reversed, if deemed advisable. The trocar is to be withdrawn, leaving the cannula in place. This step of the operation is not performed until immediately before the application of the graft, and is done after the patient has been anesthetized.

A flap of vaginal mucosa, taken from a woman who requires a repair of the perineum, is used. It should be equal in length to the segment of the urethra which is to be replaced in the male patient, and its width should be such that it can easily be sewed around a seventeen or eighteen

French bougie. While one operator is continuing the perineal operation, an assistant prepares the graft by denuding it of all fat and cellular tissue, and then sewing it around a bougie with very fine silk, the two ends being tied with catgut sutures, which are left long, so that they may be used in drawing the tunnel of mucosa so formed into the channel prepared for its reception. The latter part of the operation has proved difficult, the graft being too large for the cannula. In some cases it was necessary to remove the graft from the bougie and to fasten it in the wound without any guide except a small platinum tenaculum, which was first passed through the cannula and made to catch one of the catgut sutures at the end of the tubular graft. When this step of the operation has been accomplished, the cannula is withdrawn and the two ends of the urethra are carefully sewed to the extremities of the transplanted tube of mucous membrane by a number of silk sutures. The two urethrostomy openings are dissected free, and are then closed with sutures of silkworm gut. The wound is not disturbed for eight days. At the end of that period a very small bougie is passed, after which regular dilatation with instruments of increasing size is practised. With regard to the results the author states that in 2 cases they were excellent, and in 1 good though the duration of the treatment in all was much protracted. Two of the patients were soldiers who had been severely wounded by fragments of shell, and in whom considerable time was required to secure healing of the primary wounds. Then there was a period of waiting between the establishment of the urethrostomies and the performance of the operation to restore the urethra and to close the fistulae. Great stress is placed upon the care with which the preliminary urethrostomy should be performed. The coöperation of the patient is a valuable asset. One of Legueu's patients was drunken and very refractory to handle, and it was in his case that the result was least satisfactory. The opinion is expressed that the transplanted vaginal mucosa merely acts as a scaffolding upon which epithelial cells derived from the ends of the urethra can proliferate and become organized. As the new urethra so formed increases in size, the graft is eliminated.

Cathelin,²³ in an extensive article, reports 13 cases of URETHRAL FISTULA due to war wounds successfully TREATED BY his method of CUTANEOUS INVERSION. The technic of the operation is described practically as follows:

After the affected part has been rendered as nearly aseptic as possible, the fistula is circumscribed with the point of a bistoury at a distance of 3 to 5 mm. from its center. The sound in the urethra facilitates the making of this incision, as it steadies the parts. The little circular or elliptical flap thus formed is dissected up in such a manner as to form a collar, which is attached only at the summit of the fistula. Care must be taken not to buttonhole the tissues while it is being raised. Then the raw surface made by raising the skin is enlarged by two incisions, one at each extremity. The two new flaps are raised by separating the skin from the subjacent tissues. The next step of the operation consists in

²³ Journal d'Urologie, August, 1918.

dividing the rounded flap of skin containing the opening of the fistula at each pole in such a manner as to make two valves, which can be turned in toward the urethra, this maneuver bringing the raw surfaces in contact with the urethral mucosa. By means of fine, straight intestinal needles threaded with either number 0 or 00 silk, the ends of these inverted flaps are sewed fast. One is placed centrally and one at each side. To reinforce the inversion, other silk threads are passed through the tissues beyond, and the skin is then sutured together in a straight line. The smallest intestinal needles are required for the deep sutures. Not uncommonly little abscesses develop a few days after the operation, but they discharge their contents into the urethra, rather than through the skin. No instrument should be retained in the urethra, the intermittent use of the catheter or sound answering every purpose. The author expresses the opinion that it would be safe to allow the patients to urinate after twenty-four hours.

In addition to the 13 traumatic cases, Cathelin has operated upon 9 patients who had fistulæ resulting from inflammatory disease. The site of these abnormal openings was variable, some involving the penile portion of the urethra, and others the scrotal or perineal parts. Out of this number, there were only two failures, complete cures having been obtained in 7. Thus it is seen that recent traumatic fistulæ offer a better prognosis. The author also made 4 attempts to cure a fistula that had been caused by a phagedenic chancre.

Acriflavine in the Treatment of Gonorrhea. From time to time, some new drug or new method of applying an old one is recommended for the treatment of gonorrhea; and not infrequently startling statements are made concerning its efficacy. Thus we hear of the disease being aborted in two or three days, or are told that a few injections of a given drug cause a subsidence of all symptoms and a disappearance of the specific organisms from the discharge. Unfortunately, continued experience with such drugs and methods fail to prove them to be of as much value as one would expect from what has been published concerning them. For instance, we find that there are not many genito-urinary surgeons today who have had great success in aborting gonorrhea by sealing a solution of organic silver in the urethra, although, a few years ago, this method was heralded as one that would seldom or never prove disappointing. Fifteen years' experience has not sufficed to convince me that there is any rapid cure for gonorrhea. As a matter of fact, among my private patients there has been only a single case in which the symptoms had completely subsided and the gonococci had permanently disappeared from the urethral secretions at the end of fourteen days. Therefore, I am not enthusiastic regarding any reputed rapid cure for Neisserian infection. However, my mind is open, and I consider it worth while to give some attention to each and every new drug or new method of treatment that may be introduced, provided that the latter is not too grotesque. The internal administration of gonorrheal discharges, as was recommended by someone a few years ago, has not been tried; nor has packing of an acutely inflamed urethra with gauze saturated with a silver solution seemed advisable.

A recent contribution from the Brady Urological Institute of the Johns Hopkins Hospital, Baltimore, is not only interesting, but impresses one that the method of treatment described is founded upon sound scientific principles, even if further experience shall prove it to fall short of what its promulgators hoped might be accomplished by it. In August, 1918, Davis and Harrell called the attention of the profession to a chemical dye, *acriflavine*, which was one of several substances with which they had experimented. This substance was found to be exceedingly diffusible and to penetrate the tissues to a remarkable degree. At the suggestion of J. T. Geraghty, it was decided to use a solution of it as an injection in gonorrhea. In addition to the physical properties above mentioned, this dye possesses strong antiseptic qualities, which render it even more applicable to the purpose for which the authors employed it. Experiments showed that it inhibits the growth of the gonococcus in protein-containing media when used as weak as 1 to 300,000.

For urethral injections solutions varying in strength from 1 to 2000 to 1 to 100 were tried, 1 to 1000 being recommended as the best for general use. The injection of such a solution into the urethra causes slight burning, which usually lasts for about an hour. When the anterior urethra only is involved, the authors recommend that 3 c.c. of the 1 to 1000 solution be injected and held for five minutes. When there is involvement of the posterior urethra, they inject from 15 to 30 c.c. through the urethra into the bladder, also completely distending the urethra for five minutes, after which the solution is allowed to escape. That which has been forced into the bladder, however, is retained until the patient feels a natural desire to void. The injections are made twice a day until all bacteria have disappeared from the discharge, and then once a day until there are no symptoms of disease. The authors state that all their results were controlled by a daily examination of smears from the urethral discharge and of the urine voided in three portions.

With regard to results, they say that the discharge was markedly decreased from the beginning of the treatment and that it usually disappeared by the fifth day. In some cases the gonococcus disappeared from the discharge after a single injection, and could not be demonstrated in any smears subsequently made. It is notable, however, that they admit having had recurrences. This is a rule, I believe, from which there will be little deviation under any form of treatment. In 4 cases the drug was found to be without any effect whatever, and in 2 of these injections of protargol produced an immediate amelioration. All in all, it seems to the authors that the average duration of a case of gonorrhea subjected to the acriflavine treatment is distinctly less than with the methods usually employed.

No mention was made of this method in last year's review, it having been considered better to wait until some further experience with it had been recorded. Shortly after the publication of Davis and Harrell's paper, I tried to obtain some of the drug, but failed to get any; and not being enthusiastic about it, I did not make a second attempt. During the year very few contributions have been made to the subject. Some

of the British surgeons speak well of the drug. For instance, David Watson²⁴ states that he gives it first place in the venereal clinics under his control. He has obtained brilliant results in a certain proportion of cases with injections of the solution in the strength of 1 to 1000, although it is apparent that he prefers copious lavage with a weaker solution (1 to 4000). In this author's experience, the discharge has apparently decreased to about one-third within twenty-four hours after the institution of irrigations, and has usually disappeared by the third day, leaving only a little moisture in the morning. After three or four days' treatment, the gonococci have not been seen in smears. If the treatment is stopped the fourth day a discharge laden with gonococci will reappear. Therefore, he recommends that the irrigations be continued for twelve days. If, at the expiration of that period, the smears are negative, no morning drop can be expressed, and the urine is free from pus and shreds, the treatment may be stopped. If there is no recurrence within four days, the patient may be discharged. Watson's cases were in the military service and he sent the men back to duty after they had remained apparently well for four days. In criticism of this method, it may be stated that the patients may have failed to report slight recurrences. If they were free from subjective symptoms, it is not improbable that some of them may have neglected to report the recurrence of their discharge. However, Watson's conclusion, that irrigation with 1 to 4000 solution of acriflavine is the most satisfactory routine treatment for acute gonorrhea at present available, is one that is worthy of consideration.

Ashcraft and Kennell²⁵ have experimented with the drug at the League Island Navy Yard, having treated, in all, 67 cases, of which 26 were acute, and 45 chronic, although their report is based on only 50 cases out of this number. They used a solution that varied in strength from 1 to 1000 to 1 to 500, giving the injections themselves, rather than entrusting them to the patients. Stronger solutions were employed in the acute cases, the weaker being reserved for those that were of longer duration. In acute anterior urethritis three injections a day were given. When the posterior urethra was involved, the solution was forced into it. In certain cases complicated by prostatitis 25 c.c. of a 1 to 1000 solution were injected into the bladder, and the prostate then massaged.

Under the acriflavine treatment the authors found that the discharge rapidly subsided after a few injections—in some cases, even after one or two. A rapid disappearance of the gonococci took place, as shown by the examination of smears from day to day. The authors state that many patients whose infection had not yielded to the methods commonly in vogue responded very favorably to the acriflavine treatment, although they found that the most brilliant results were obtained in the acute cases. They are so well pleased with the results that they state they are almost compelled to believe their "findings are too good to be true."

In view of the paucity of literature on the subject, J. E. and T. D.

²⁴ British Medical Journal, May 10, 1919.

²⁵ Hahnemannian Monthly, May, 1919.

Hall,²⁶ of Nashville, Tenn., sent a circular letter to a number of genito-urinary surgeons, asking for a report on their experiences with the drug. The replies received showed that a majority of those addressed had not used acriflavine to any extent. A few were very favorably impressed with it, and expressed the opinion that it may supersede the older drugs. On the other hand, some were not very sanguine about its future. Hugh Cabot has not had any experience with it in the treatment of gonorrhea, but has had ample opportunity to observe its action upon wounds. He has found it to possess in high degree the power of inhibiting the growth of bacteria, with the result that it makes wounds appear unusually clean. Associated with this property, however, he has observed the attribute of preventing the repair of tissue; so that raw surfaces two weeks old looked very much like fresh wounds. He remarks that if it should act in this manner upon the urethral mucous membrane, it might give rise to a persistent chronic inflammation. This is a point well worth bearing in mind. As a matter of fact, cases have been reported in which a non-gonococcus-bearing discharge has been produced by a continuation of the acriflavine injections; that is to say, the specific microorganisms disappeared from the discharge, the discharge ceased, and then came back again as the injections were continued. Another opinion submitted is that of John R. Caulk, of St. Louis, who says that at first he thought the drug was wonderful, but that continued experience with it has been very disappointing. It is to be hoped that further knowledge of this substance may be gained within the next year.

Provocative Injections of Gonococcus Vaccine. Every genito-urinary surgeon realizes that it is a hazardous undertaking to assure a patient that he is completely cured of an attack of gonorrhea. Those who have had any experience at all in the treatment of the disease know that late recurrences are all too common. Of the various tests devised for bringing inactive gonococci out of their hiding places, there is none that is infallible. The "beer" test, the passage of sounds, and the use of irritating injections are all so unreliable that it is hardly worth while to resort to them. They may fail to produce a secretion containing the gonococcus, only to be followed, a little later, by the recurrence of such a secretion without any assignable cause. Another of the tests that has received some consideration of late years, is the injection of gonococcus vaccine, its use being based upon the fact that an increase in the amount of the urethral discharge, as well as in its gonococcal content, is frequently found to follow the therapeutic employment of this substance. As Pearson expresses it, the increased endotoxin is too much for the defensive immunity produced against the original infection, so that there is a temporary lowering of the resistance of the tissues, and the gonococcus is permitted to proliferate with greater freedom. This is the so-called negative phase. Gerald H. Pearson,²⁷ who has used this test in 100 cases, states that he found it reliable in 96 per cent. of the total number, although he did not rely upon it solely. He prefers to

²⁶ Urologic and Cutaneous Review, August, 1919.

²⁷ Journal of Urology, December, 1918.

give two small injections upon successive mornings rather than to use a single large dose. On the first morning, he gives a dose of three million gonococci of different strains, and then massages the seminal vesicles, the prostate and Cowper's glands, so as to liberate any toxins which may be confined in them. The patient is then instructed to hold his urine from twelve o'clock that night until the next morning, when a smear of any urethral secretion which may be present is taken. On the second morning, a dose of five million dead gonococci is given. Smears are taken for four mornings. It is interesting to note that the patients in whom negative results were secured did not develop any recurrences; so that they may be considered as being free from infection at the time that the provocative dose of vaccine was given. All of Pearson's patients were confined in a military hospital and he was thus able to keep them under observation. He believes that this method will prove useful in differentiating between specific and non-specific urethritis, as well as giving fairly definite information as to the cure of gonorrhea.

DISEASES OF THE TESTICLES AND EPIDIDYMES.

Undescended Testicle. Formerly it was a common practice for surgeons to remove a testicle retained within the inguinal canal, it being believed that the organ could not be satisfactorily carried into the scrotum. Another reason for its sacrifice was the belief that it was functionally inactive and, therefore, of no use to the patient. Of late years more conservative surgery has been practised, the operation being performed in children, in whom atrophic changes may not have proceeded to the extent they have in adults. More consideration has also been given to the psychic effect of retaining the organ in those patients who have attained maturity.

Bevan's operation is now a well-recognized surgical procedure. In a recent contribution by William B. Coley,²⁸ of New York, whose opportunities for observing cases of undescended testicle, in connection with a large number of inguinal hernias which come under his care at the Hospital for Ruptured and Crippled, is exceptional, the pathology and treatment of the condition is fully discussed. In the twenty-eight years from 1890 to 1918, 80,736 cases of inguinal hernia in the male were recorded at the Hospital, and out of this number 1357, which gives a percentage of 1.68, were associated with an undescended or maldescended testicle. In the same period of time 4453 cases of inguinal hernia in the male had been operated upon, and out of this number there were 334, or 7.5 per cent., which were complicated by non-descent of the testicle. At the General Memorial Hospital 1040 cases have been operated upon, of which 49, or 4.71 per cent., were also complicated by undescended testis. Despite the fact that conservative surgery has been more extensively practised during the last fifteen years, no large series of cases in which the end-results are known have been published, and Coley states that the principal object in presenting his cases is to give some informa-

²⁸ Surgery, Gynecology and Obstetrics, May, 1919.

tion with regard to the condition of patients several years after operation. He presents an analysis of 334 cases, out of which number it was possible to learn the ultimate result of the operation in 185. It is shown in the following table:

Traced and well.	Number of cases.
More than twenty years	1
From ten to twenty years	16
From five to ten years	41
From two to five years	60
From one to two years	31
From six months to one year	21
Less than six months	15
	<hr/> 185

Thus the end-results show that it is possible to cure the hernia in practically all cases. In only a comparatively small number, however, was the testicle found in the bottom of the scrotum where it was placed in every instance at the time of operation. Usually, it was found to have retracted somewhat, in some cases being as high up as the external abdominal ring, although frequently it did not ascend beyond the middle of the scrotum.

The opinion is expressed that the undescended testis should never be sacrificed in children, and its retention in adults is also urged for the psychic effect, even if it be functionally inactive and if some technical difficulty is encountered in placing it at a lower level in the scrotum. Coley does not advocate operation in children of less than eight years of age, and, in cases in which the hernia is small and not giving rise to discomfort, he considers it better to wait until the child is ten or twelve years old before performing the operation.

With regard to functional value, Coley states that he believes the power of spermatogenesis to be retained in a small percentage of cases, though certainly in not more than 10 per cent. He likewise upholds the theory that malignant disease is more likely to develop in the retained testicle than in the normally situated organ. The atrophy is not considered to be caused by the malposition of the organ, but rather to be dependent upon the congenital causes which are responsible for its non-descent.

Three distinct types are recognized, the most common being that in which the testicle is in the inguinal canal. The next type is the inguino-superficial, in which the vaginal process, after passing through the external abdominal ring, turns backward and upward and extends two or three inches beyond the anterior superior spine of the ilium, the testicle usually occupying the distal portion of the sac and resting upon the outer surface of the aponeurosis directly beneath the skin and superficial fascia. This type, which has been considered rare, is evidently not very uncommon, for 77 cases have been observed at the Hospital for Ruptured and Crippled. The third type is the inguino-perineal, of which 8 cases have been seen by the author. In these cases the cord is usually normal in length, so that the testicle can easily be transplanted to the scrotum.

The Bassini operation, without transplantation of the cord, is done for cure of the hernia. In nearly all cases of inguinal retention and in many cases of abdominal retention Coley has found that the cord can be liberated enough so that the testicle can be drawn at least into the upper portion of the scrotum and in the majority of cases into the lower part. Suturing of the testicle to the scrotal tissues is not considered of value. In cases in which the testicle cannot be brought down by this simple method, the author resorts to Bevan's procedure. He states that the testis has shown a greater tendency to remain in the scrotum in adults than in children.

Tumors of the Testicle. Two important contributions to this subject have been made by O'Crowley and Martland,²⁹ of Newark, N. J., and one by Hinman of San Francisco, who deals especially with the radical operative treatment. The former authors have given considerable attention to the morbid anatomy of the new growths, and, as the result of their studies, they state that if more tissue had been sectioned in the past a greater proportion of teratomas would have been reported. In fact, they express the opinion that almost every growth met with in the testicle is a teratoma, appearing in one of two forms, the first containing tissue derived from all three embryonal layers and the second being an embryonal carcinoma. The latter, which is the more common, may be made up of polyhedral or round cells, may be alveolar and may even contain lymphoid tissue. Metastasis occurs principally through the lymph system, as a rule first involving the retroperitoneal lymph nodes. The metastases are carcinomatous in structure rather than teratomatous. Attention is called to the fact that the testicle, which develops from the genital bodies, is in close relation to the Wolffian body and that the kidney and adrenal, which develop from the latter, are subject to many irregularities of intra-uterine growth.

A summary of 13 cases is given. Out of this number there were 7 which terminated fatally owing to the occurrence of metastases. In 6 out of the 13 there was a definite history of injury, although it cannot be stated that the injury was causative of the growth for, as so often happens, it may merely have served to attract the patient's attention to the presence of a swelling in the testicle. In the majority of cases the development of the tumor was slow, but constantly progressive. The longest duration of the disease was two years and seven months, the shortest ten weeks. The youngest patient was five years old, the oldest fifty-two years. One patient was still living five years after removal of the affected organ. Two were still living at the expiration of one year, and one after a lapse of fifteen months.

With regard to size, these tumors may vary from that of a horse chestnut to that of a cocoanut, depending upon the period of their evolution during which the patient seeks advice. As they are painless, at least in their early stages, the patient may pay very little attention to them until they attain sufficient size to become annoying. They may be firm and hard or soft and semi-fluctuating, the latter condition being due either to degeneration or to the rupture of bloodvessels, which produces a hematoma.

²⁹ Surgery, Gynecology and Obstetrics, May, 1919.

Hinman, whose previous paper may be remembered, makes another contribution in which he reports 5 cases in which the radical operation was performed. All of these 5 patients were alive and well at the time his paper was published, although sufficient time had not elapsed to enable one to draw any conclusions as to the ultimate result of the operation. One, however, has gone three years and six months without any recurrence. In four of Hinman's cases malignant metastases to the retroperitoneal lymphatic tissues was shown by the microscope, and he rightly states that if a cure is obtained in any of these cases it will have been due to the early removal of metastatic growths. In view of the high mortality which follows simple castration, it being 87 per cent. in the series of cases which the author reported from Johns Hopkins Hospital five years ago, a strong plea is made for the performance of the radical operation in early cases. The author states that this operation is not as difficult nor as dangerous as it is generally believed to be. In his 5 cases there were no troublesome operative or postoperative complications. In 2 cases an enlarged gland was dissected free from the vena cava and some troublesome hemorrhage was encountered as the result of rupture of small veins which emptied into that large vessel. One patient developed a phlebitis which, however, completely subsided.

The operation is done in two parts. The patient is placed in what the author terms a bent dorsolateral position, which is about half way between the lateral and dorsal one. A medium-sized pad is placed under his ribs on the opposite side, and the opposite leg is slightly flexed, while the one on the affected side is kept straight. At first a simple castration is done through a high inguinal incision, the cord is dissected, clamped and divided with the cautery, the clamp being left in place so that traction can be made upon the stump of the cord later in the operation. If examination of the removed testicle shows it to be malignant, the incision is then extended upward and outward to a point about 2 cm. inside the anterior superior spine of the ilium, whence it is curved upward and made to terminate a centimeter below the tip of the twelfth rib. The external oblique muscle, the internal oblique, the transversalis and the latissimus dorsi are divided in turn throughout the length of the skin incision, the deep incision beginning at the external abdominal ring, from which point it is carried through the various muscular strata. Care is taken to preserve the hypogastric branch of the iliohypogastric nerve, although the iliac branch has to be sacrificed.

In stripping up the peritoneum, some difficulty may be encountered in the lower portion of the wound where it is in relation with the iliac vessels and the bladder. If traction be made upon the stump of the cord as the peritoneum is stripped up, the ureter and spermatic vessels can usually be kept separate from the peritoneum, and thus the possibility of making a clean retroperitoneal dissection will be considerably enhanced. The author advises that the lower part of the dissection be completed before any attempt is made to raise the peritoneum on the upper portion of the posterior abdominal walls. After the vas has been divided at the point where it disappears behind the bladder, no difficulty is to be experienced in stripping back the peritoneum to the site of the bifurca-

tion of the aorta. In all cases the peritoneum should be separated as high as the pedicle of the kidney. In 3 of those operated upon by the author the largest lymph node was found at this level. Broad retractors are used for displacing the peritoneum and its contents. When the exposure has been satisfactorily made, the lymphatic tissues are dissected away from the iliac vessels and the aortic bifurcation, and then a dissection of the pre-aortic lymph areas and spermatic vessels is made. In all the author's cases masses of lymph tissue were found on the external and common iliac vessels, extending as high up as the aorta. Its removal was accomplished by blunt dissection. At the bifurcation of the aorta the mass may extend deep down on to the sacrum, so that care is necessary in removing it lest the midsacral artery be severed. The ureter is dissected free and retracted by means of a narrow tape placed beneath it. After the diseased tissue has been removed, a long drainage tube is inserted into the wound, which is then sutured in layers. The author states that in those cases with extensive metastases a tube of radium, fastened to a catheter or other carrier, might be placed alongside the drainage tube and the whole diseased area thus be irradiated by withdrawing the carrier a few inches at a time at intervals of one or two hours.

X-ray Treatment of Tuberculous Epididymitis and Orchitis. A contribution to this subject by Abraham Hyman,³⁰ of New York, is of interest. He reports 2 cases in which excellent results have been obtained, one of the patients being affected with bilateral tuberculous disease. At the time the latter patient came under Hyman's care, he had an acutely inflamed epididymis on the left side and also showed evidence of other signs of tuberculosis. He ran the usual course in such cases and within six weeks had developed two discharging sinuses over the epididymis and one which communicated with the testicle. Shortly afterward the left epididymis became involved and within three weeks sinuses formed. The patient refused operation and consequently it was decided to try x-ray treatment. The applications were made once every ten to fourteen days for two weeks, ten treatments in all being given. Marked improvement was noticed after the fifth treatment and after the eighth the sinuses had closed, the nodules had almost disappeared and the testicles were nearly normal in size. The prostate and vesicle had become softer and less irregular, and the patient did not complain of any urinary disturbance. About a year after the last treatment the patient reported for examination, and at that time the testicles and epididymes were normal in size and there were no sinuses or indurated areas in those organs nor along the vasa deferentia.

The second case was that of a man who had developed a discharging sinus four months after he first noticed some enlargement of the left epididymis. When he first came under observation, examination showed that the disease had not involved the testicle. There was a discharging sinus at the lower part of the scrotum, which connected with the epididymis, and the left vas was considerably indurated. In view of the

³⁰ Urologic and Cutaneous Review, May, 1919.

satisfactory result obtained in the case just reported, the author decided to try *x*-ray treatment in this case. In all, the patient received nine applications, one being made every two weeks. After the sixth exposure the sinus closed and the epididymis began to undergo resolution. One month after the last application, it had become normal in size and consistency, and the thickening of the vas had entirely disappeared.

So far as is known, the *x*-rays were first used for tuberculous epididymitis and orchitis by DeGarmo who, in 1905, reported a case in which an excellent result had been obtained. It was used in a case in which one testicle and epididymis had been removed and in which the other side became involved a short time after the operation.

In view of the advances which have been made in *x*-ray therapy and the demonstrated value of massive doses in a variety of affections, it would seem judicious to subject all patients who have had unilateral orchidectomy performed, and who later developed the disease on the opposite side, to a thorough course of *x*-ray applications before suggesting further operative treatment.

With regard to using the rays in earlier cases, Hyman expresses the opinion that if spermatozoa are present, such treatment should not be resorted to, for the reason that the rays destroy the spermatogenetic function of the testicle. If a patient should refuse to have an epididymectomy performed, however, it seems to me there should be no objection to giving him *x*-ray treatment. As the *x*-rays have no injurious effect upon the interstitial cells of the testicles from which the internal secretion is derived, no physical or psychic disturbance would be likely to follow their use.

MISCELLANEOUS.

Whiteside,³¹ of Portland, Oregon, discusses:

Radical Surgical Treatment of Genital Tuberculosis. His operation is similar to that performed in 1909 by Pauchet, and ten years earlier by Veloseroff, although when Whiteside first did the operation, in 1910, he was unfamiliar with the work of those two foreign surgeons. Since that date, he has performed the operation twenty times, although it is only in one case that he knows the ultimate result. His first patient, when last seen, in 1918, eight years after operation, had remained free from recurrence and had gained nearly fifty pounds in weight. Several other patients have been under observation for a number of months, but none for more than two years. Several died from pulmonary tuberculosis within a year after the operation, and one developed a fulminating miliary tuberculosis that carried him off in a few weeks. At present, Whiteside advises against operating upon patients who show even the slightest signs of pulmonary involvement, as his results in all such cases have been disappointing.

The operation is performed as follows: The testicle is removed through the usual scrotal incision, which is prolonged into the groin, the cord being dissected up as far into the inguinal canal as possible,

³¹ Northwest Medicine, May, 1919.

clamped and divided with scissors. The forceps are left upon the stump. Then the patient is placed in the lithotomy position, and a semilunar incision, convex anteriorly, is made between the ischial tuberosities. This incision is deepened, the central tendon of the perineum divided, and the rectum separated by blunt dissection. By carrying the finger into the apex of the perineal wound thus made and pushing down on the forceps attached to the stump of the cord in the inguinal canal, it is possible to force the clamp through into the perineal wound, dragging the cord with it. Another clamp is then applied to the stump of the cord with it. Another clamp is then applied to the stump of the cord through the perineum, the one previously holding it being removed. By making traction upon the stump of the cord thus held in the perineal wound, manipulating the attached clasp from time to time, as may be necessary, one can, according to Whiteside, dissect the entire vas, seminal vesicle and lateral lobe of the prostate free upon each side and remove it. It is considered important, however, not to take the prostate out until the other structures have been thoroughly freed. Then all three can be excised together. After all the diseased tissue that it is possible to reach has been removed, a light gauze pack is placed in the perineal wound, and the scrotal and inguinal wounds are completely closed. Whiteside considers this a formidable and difficult operation, but one that has a distinct place in genito-urinary surgery. He has not had any alarming accidents during its performance. An unpleasant postoperative sequel that has not been uncommon, is the persistence of one or more sinuses.

Neuralgia of the Testicle Caused by Adhesions of the Tunica Vaginalis. Posados,³² of Buenos Ayres, describes a form of testicular neuralgia that he believes to be caused by adhesions of the tunica vaginalis to the testicle or epididymis. These adhesions may follow inflammation of the latter structures or, in some cases (at least, so the author thinks), they may be primary. They may vary from one or more simple adhesive bands to a fibrous thickening of the greater part of the tunica vaginalis, which becomes firmly united with the testicle or epididymis. The author has operated upon 8 patients thus affected.

The operation is practically the same as that done for the radical cure of hydrocele, in that the tunica vaginalis, after the adhesions between it and the testicle have been broken up, is either inverted or resected. Special care is taken to staunch any bleeding that may follow the breaking up or cutting of the adhesions. All blood is mopped away and the bleeding points are repeatedly sponged with gauze that has been wet in very hot salt solution. A small drain is introduced into the wound at its inferior angle, and an antiseptic dressing is applied to the scrotum. The author practises this operation under local anesthesia. After the superficial tissues have been infiltrated and cut through, the tunica vaginalis is punctured; and then from 5 to 10 c.c. of the anesthetic solution are injected into its cavity. This acts upon the testicle in such a way as to permit of its manipulation without causing the patient much pain.

³² *Semana med.*, August 1, 1918.

Some of the cases that came under the author's observation had evidently been caused by previous gonorrheal epididymitis. Others were affected with varicocele. I recently saw a patient who, about twenty years ago, had a varicocele operation, after which he developed a testicular neuralgia. A few years ago he had another operation performed, and he showed me a letter from the surgeon who operated upon him, in which it was stated that adhesions had been found between the tunica vaginalis and the epididymis and testicle. This patient, unfortunately, experienced very little relief from the second operation. Posados was more successful with his patients. All of them, so far as he knows, were relieved of pain and suffered no recurrence.

He states that although the diagnosis is not always readily made, there are certain symptoms that may be elicited by careful examination. Thus, the scrotum is usually relaxed, and unless there is an associated varicocele, it looks very smooth. The epididymis is commonly enlarged throughout, and small nodules may be detected in one or both of its extremities, although they are most frequently found in the lower pole. Careful palpation of the testicle will also reveal localized areas of thickening, varying in extent with the size of the adhesions. The entire testicle and epididymis are abnormally sensitive to slight pressure. There may be a small amount of fluid in the cavity of the tunica vaginalis. In those cases associated with varicocele, the intensity of the pain is out of proportion to the degree of dilatation of the veins. Some of the most painful cases that the author has seen were those in which the varicocele was small.

The literature of this subject is scanty, although the author alludes to cases described by the older surgeons (for example, Parker and Langenbeck) and describes one reported a few years ago by Ballenger and Elder.

The Prevention of Venereal Diseases. Since the beginning of the war, in 1914, much attention has been given by the different governments whose countries were involved in the great struggle to safeguarding their soldiers against the ravages of venereal disease; and, from time to time, papers by army surgeons dealing with the various aspects of the subject have been published. Some of these, notably the ones published by the Italian surgeons during the first months after Italy mobilized, described in detail the methods of repression which the authorities adopted. Others, especially some by English authors, dealt with the social methods that were employed for the purpose of affording the soldiers healthful amusement and entertainment. In this country, the work of the Young Men's Christian Association, the Knights of Columbus and the United Hebrew Societies is well known. That something is to be gained from such measures is not to be doubted. They have not, however, proved quite as effective as might be desired.

A unique method of interesting the men in the subject has been its presentation on the screen. H. E. Kleinschmidt,³³ of the Navy Department Commission on Training Camp Activities, describes this method

³³ Social Hygiene, January, 1919.

in detail. The stereomatograph, which was installed in the camps, is operated by electricity and equipped with its own screen, and is so arranged that a series of fifty-two slides can be shown consecutively, each picture remaining on the screen about twenty seconds. The author's experience showed that many men who were at first attracted more by the mechanical features of the machine, remained to see the entire series of slides. Several sets of pictures were supplied with each machine.

The author speaks very highly of the Griffith film, entitled, "Fit to Fight," in which the producer has compressed into drama form the entire program for combating venereal diseases. In the first reel the company commander's talk to his men is depicted, and in the following reels, two important facts are illustrated, *viz.*: that sexual continence does not impair one's health; and that gonorrhea and syphilis are dangerous diseases, which lessen the soldier's military worth.

Certain placards, which were posted in conspicuous places, are also described. In a series of twenty-five such posters, the subjects of sex hygiene and the prevention of gonorrhea and syphilis are covered. It is to be hoped that such methods can be made applicable to the instruction of civilians. The wisdom of showing such pictures to mixed audiences, however, is debatable. Here in Philadelphia such a film was produced under the auspices of the State Department of Health, but there was so much criticism of it that the authorities forbade its continuance.

Now that the war is over, the question of protecting the men, both those in camp and those who are demobilized, is just as important from the personal standpoint of the soldier as was that of keeping them from disease while they were in active service. That the subject still continues to require the careful attention of the military and medical officers is apparent from the communications which continue to appear in the various medical journals.

Of the more recent papers which have been published, some describe the methods that were found most effective in actual service; some present critical reviews of the various measures of suppression and repression that were adopted; and others are of a controversial nature, in that they take issue with the opponents of regulation and immediate prophylaxis.

Under the title, "The Policy of the Ostrich," Col. J. G. Adami³⁴ points out the decrease in the incidence of venereal diseases in the army since the necessity of combating infection by every possible means finally came to be recognized by the government. He asserts that in peace times no other conditions equal venereal diseases in lowering the efficiency of the soldier. Nevertheless, in view of this well-known fact, at the time that training camps were being built all over England, no measures were taken to render the regulations against prostitution more rigid. In the autumn of 1914, when the first Canadian troops arrived in England, it soon became apparent to the officers in charge that neither the civil nor the military laws were equal to the task of coping with the conditions that were then existent. Adami states that approximately one hundred

³⁴ British Medical Journal, January 25, 1919.

prostitutes came out to Salisbury from London every Saturday, and that there was no way of preventing them from making their weekly trip. There was no regulation to keep them from travelling on the railway, nor any that permitted the town authorities to drive them away when they reached their destination. It took nearly two years before the government made use of the authority conferred upon it by the "Defense of the Realm Act," and during that time all that could be done was to instruct soldiers upon the "wickedness and danger of exposing themselves to infection." It required the better part of three years before the authorities openly recommended those who lectured to the soldiers to advise immediate prophylaxis after exposure.

Adami recommends the employment of every possible measure—education, repression, protection, personal prophylaxis, and penalties for failing to make use of the latter. Every Canadian orderly medical room in England is now an early treatment center, where, at all hours of the night, as well as during the day, prophylactics can be secured, and instructions for their use given by qualified nurses. For the soldiers on leave in London there are two so-called early-treatment centers. The men who use preventive applications in these centers have another given them as soon as they get back to their own camps. There is also such a center for Canadian soldiers in Paris. The experience of the Canadian medical officers, according to Adami, has shown that even under expert supervision, there will be an occasional infection after prophylactics have been used. A point in this connection has been well brought out by Reid and Boyden,³⁵ British medical officers, who insist upon primary prophylaxis; that is, the application of antiseptics immediately after intercourse, thereby not allowing any interval—perhaps one of several hours—to elapse before the germicides are applied.

Reid has been in charge of a rapidly changing body of men, usually numbering about 2000. Up to the end of 1916, venereal disease was prevalent among the men, despite the numerous moral lectures and the so-called early treatment, the latter meaning disinfection after the men have returned to their quarters. At the beginning of 1917, they were instructed to use disinfectants immediately after exposure. Each man who applied received an ounce of solution of potassium permanganate (at first, 1 to 2000; later, 1 to 1000) and a small applicator of cotton-wool, and was fully instructed how to make the application. During 1917 and 1918, about 20,000 men passed through the station. Out of this number, only 7 contracted any form of venereal diseases. There were 6 cases of gonorrhea and 1 of syphilis. Of the former, 2 were contracted by men on leave; and in each instance from the man's own wife. Two of the others who contracted it were drunk at the time of exposure and did not use any preventive applications. The fifth man was infected the night that he arrived at the station and, being unaware of the system of prophylaxis in vogue, did not avail himself of the opportunity to use it. The sixth man did not use any antiseptic until an hour after exposure. The man who contracted syphilis did not use the treatment until two hours after exposure.

³⁵ British Medical Journal, February 8, 1919.

Boyden relates his experience in the Royal Navy since 1907. About a year and a half before the publication of the paper, he took charge of a station in which there were 2000 men, including officers. The incidence of venereal diseases of all kinds, especially gonorrhea, was high; and investigation revealed the fact that about 40 per cent. of the men who had used prophylactic applications of nargol later became infected. The conclusion was drawn that the nargol jelly was an inefficient, if not a useless prophylactic; so that a change to potassium permanganate was made. Among those using the latter, not a single case of gonorrhea developed, and only one case of syphilis. That case occurred in a man who had waited six hours after exposure before taking any preventive treatment. Calomel cream is still used upon those who have omitted to provide themselves with the permanganate solution, as the author believes in common with many others, that a mercurial application may be of service even an hour or two after contamination. Both Reid and Boyden attribute no especial action to the permanganate; but, as it is easily procured, non-irritating and not poisonous, it is recommended in preference to certain other antiseptics, which, in all probability, would prove as efficient.

Another communication by an Australian surgeon, Sir James W. Barrett,³⁶ is of interest. He narrates his experience in Egypt during the war, and also alludes to the efforts made in Australia to deal with venereal diseases before the war. He recounts how, in the period from 1911 to 1914, efforts were made to educate the public with regard to the danger of these diseases, and to disseminate knowledge as to the methods of preventing them. In 1911, a committee of medical men and women was formed, and an arrangement was made by them with apothecaries to prepare and offer for sale prophylactic packages. Before this action was finally adopted, a circular was sent to every medical man and woman and every clergyman in the State of Victoria, in which they were asked to express their opinion on the subject. All of the physicians who answered expressed their approval. Of the 800 clergymen, only about 60 replied; and the majority of this number expressed their disapproval. A strong minority, however, were in favor of the measure, although they regretted that such a step should be necessary. At the outbreak of the war, Sir James was sent to Egypt, where he immediately began to instruct the soldiers concerning the nature, danger, prevention and treatment of the various venereal diseases. By 1916, the incidence of the diseases was so great that it alarmed both the civil and the military authorities; and, consequently, more stringent measures of repression were put into operation. These included rigorous repression of public indecency, the restriction of the sale of alcohol and the punishment of all male panderers to vice. Furthermore, all prostitutes were frequently subjected to careful medical examinations, and the soldiers were provided with prophylactics. Moral and hygienic lectures were also given regularly to the men. By the middle of 1917, the diseases were again well under control. With the advance into Palestine, however, and the lessening of the

³⁶ British Medical Journal, February 1, 1919.

rigorous measures above mentioned, another outbreak took place, to be followed again by repressive measures, which were equally as efficient as when previously resorted to. The prophylactic measures recommended by Sir James consisted of washing with a solution of bichloride of mercury, 1 to 1000; irrigation of the anterior urethra with a solution of potassium permanganate, 1 to 3000; and finally, an inunction of calomel ointment, the latter being followed by the application of a bandage to prevent soiling of the clothing. In summarizing his experience, Sir James states that all the repressive measures, all the constructive social measures, all the educational efforts, and all the emotional appeals, resulted in only a limited amount of success, and served merely to lessen the incidence of venereal diseases to a moderate extent. He states that some of the men openly avowed their intention of indulging in illicit intercourse, despite generals, chaplains and doctors, and whether they were supplied with prophylactics or were not given any; although, if possible, they preferred to be safe.

With regard to the value of prophylactic applications, either primary or secondary, Sir James is convinced that both are of benefit. Of course, he believes that the sooner the application can be made after exposure, the better are the chances of success. It is evident that he has very little patience with those who decry the use of primary prophylaxis upon the ground that it will induce men to become more immoral.

Here, in our own country, the authorities, both civil and military, as well as the public in general, have become much enlightened during the last few years; and at present every effort is being made to continue the good work that has been vigorously carried on since we entered the war. As long ago as 1912, the Surgeon-General of the army published orders making it incumbent upon all soldiers returning to camp to state whether they had exposed themselves to venereal infection; and, if so, to have themselves subjected to early preventive treatment. During the war penalties were prescribed for those who failed to report at the early-treatment stations. In France, General Pershing promulgated a rule by which the venereal status of every unit must be put on record with the other papers filed by the officer in command. That the hundreds of thousands of young men in the service who have received instruction concerning the dangers and the prevention of venereal diseases will disseminate this knowledge among others after they return to civil life, is not to be doubted. From such increased knowledge much good is bound to come.

I cannot but believe that even better results would have been obtained, so far as the actual prevention of disease is concerned, had each man been provided with a prophylactic package for immediate use after exposure. Unfortunately, however, such a method was not deemed advisable by those who had the authority to decide whether it should or should not be employed.

I have recommended chemical prophylactics for years—in fact, ever since I have been practising medicine. A method that has proved entirely satisfactory consists in free washing with soap and water, followed by an instillation of 2 per cent. protargol solution into the anterior urethra,

and then a thorough application of calomel and tricrosol ointment, in a strength of 30 per cent. of the former and 2 per cent. of the latter. A soap impregnated with biniodide of mercury has been recommended, and I believe it to be valuable. The treatment that I have given to men who have applied several hours after exposure has consisted of a copious irrigation of the urethra with permanganate of potassium solution, (1 to 1000), followed by an intra-urethral application of silvol ointment and an inunction of the calomel and tricrosol ointment. What the results of this late prophylaxis have been I am unable to say, as many of the men on whom it was used were strangers, and did not report later,

It is my sincere hope that every doctor who reads this article will recommend primary prophylaxis; that is, the application of chemical germicides immediately after exposure to infection. In them we have a tangible means of preventing disease and thereby benefiting both the individual and society. It is hardly necessary to remark that every right thinking physician will not fail to admonish the young and inexperienced, not only about sexual matters, but about others pertaining to their physical and moral well-being. To preach to men about town, "rounders" and prostitutes, however, is a thing which I believe the average doctor has too much sense to undertake.

In an interesting discussion of this subject, Colonel L. W. Harrison³⁷ expresses the opinion that the best results in preventing the spread of these diseases will consist in breaking the chain at the "male end," as he terms it, where he believes that the handicap is distinctly in our favor. He calls attention to the efforts that have been made in the past to control infected women without attempting to control men who are similarly diseased. The proper inspection of women on a large scale is impracticable, and no credence is to be placed in the certificates of health that are issued to them as the result of individual examination, for the reason that they may become infected within an hour after the certificate has been issued. Recognizing these conditions, Colonel Harrison assumed that the only plan to be followed in dealing with prostitutes is to consider them all diseased, and to teach them how they may prevent or, at least, lessen the danger of infecting the men with whom they cohabit. He states that he has personal knowledge that when this method has been followed, the proportion of infections has been less than 0.15 per cent., in contradistinction to a rate that has varied from 2 to 7 per cent. when such precautions have not been taken. Another important matter is pointed out by him; and that is that the occasional or clandestine prostitute is not amenable to examination and instruction. To this class he attributes at least two-thirds of all the venereal infection prevalent in England at the present time. Those familiar with the subject have long recognized that women of this type are the most prolific disseminators of venereal diseases, and are the most difficult to control.

In this connection a contribution of considerable interest is that of Pasini,³⁸ who had a service in the Ospedale Maggiore, of Milan, consisting of 80 beds for women who lived in licensed houses of prostitution,

³⁷ Practitioner, March, 1919.

³⁸ *Giornale Italiano delle Malattie Veneree e della Pelle*, May 9, 1919.

and 120 beds for women who, although given over to prostitution, did not inhabit such houses. The incidence of venereal diseases in the two classes for a period of more than three years was 13 per cent. among the former, and 51 per cent. among the latter. This experience leads the author to believe that an efficacious prophylaxis with regard to prostitution cannot be realized except by a strict and methodical control by the authorities. As conducted by the Italian Government, it cannot be doubted that much has been done to limit the extent of venereal diseases. I have always believed that the strict regulation of prostitution would be of some value; although, of course, no panacea for the evils resulting from its practice. Pasini states that a large majority of the clandestine prostitutes presented graver, more diffuse, and more advanced lesions than did those who came from the recognized houses. Eighty-five per cent. of the 51 per cent. diseased had gonorrhea; and 77 per cent. syphilis. Chancroid was less common, being present in only 15 per cent.

After reviewing the methods employed in the American and British armies, Colonel Harrison pronounces unqualifiedly for treatment at the earliest possible moment after exposure, stating the ideal method to be that in which the prophylactics are applied within an hour after possible contamination. He, as well as Colonel C. F. Marshall,³⁹ quotes the statistics previously published by Riggs, Medical Inspector of the U. S. Navy, which are based upon more than 5000 cases. Out of this number, 1180 were treated within an hour, and only 1 contracted disease. The percentage of infections increased with each hour allowed to pass before the application of the germicides.

Since the passage of the Chamberlain-Kahn Act, funds for the care of civilians affected with venereal diseases have become available, and measures have been taken in several cities to segregate and treat prostitutes. One such system has been described by A. M. Barnett,⁴⁰ of Louisville, Ky. The sum of twenty-five thousand dollars was set aside for the State of Kentucky, and from this fund, twenty-five hundred dollars has been used each month in taking care of venereal patients. Some efforts had been made previously by the city and county authorities, acting in conjunction with the U. S. Public Health Service, but this work was discontinued when the funds from the Chamberlain-Kahn Act became available. At that time, the women patients were removed to the Louisville Public Hospital, where all new patients were also taken after they had been examined at the jail. They were women who had been arrested for street-walking or other violations of city ordinances relating to immorality.

With regard to treatment, Barnett states that for gonorrhea, irrigations of iodine and permanganate of potassium were used, together with injections of silvol or protargol, and the application of tincture of iodine to the cervix, followed by vaginal tamponing, according to the indications present in the individual case. Gonococcus mixed vaccines were given in a number of chronic cases; but the author agrees with most of the others who have tried them that it is questionable whether they do any

³⁹ Practitioner, March, 1919.

⁴⁰ Urologic and Cutaneous Review, August, 1919.

good. A number of patients with pyosalpinx were operated upon. Gonorrheal patients were not discharged as cured until five smears, properly taken, had been found negative. The smears were prepared from the secretions of the urethra, cervix and Bartholin's glands. In preparing the urethral slides, the finger was inserted into the vagina, pressure being made on the floor of the urethra, in such a manner as to force any accumulation out of Skene's glands into the urethral canal. The treatment of syphilis consisted in the administration of salvarsan once a week until six doses had been given, the quantity varying from 5 to 6 decigrams. Fifteen intramuscular injections of salicylate of mercury were given in addition to the salvarsan. After having been rendered non-infectious, the syphilitic patients were paroled for further treatment later, by their own physicians or by those connected with the hospital. More than 11,000 treatments were given prior to the first of January, 1919. On January 1, there were 240 who were receiving treatment.

For those not familiar with the provisions of the Chamberlain-Kahn Act, it may be stated that it created a Division of Venereal Diseases in the United States Public Health Service. The plan of procedure formulated consists of medical measures, law-enforcement measures and educational measures.

The medical measures include establishing clinics; securing hospital facilities for those affected with venereal diseases; making available laboratory facilities for the scientific diagnosis of venereal disease; promoting wide distribution of salvarsan; obtaining the coöperation of the medical profession and of druggists by inducing the former to give careful attention to the treatment of the diseases, and the latter to refrain from prescribing for the patients affected with them; securing the coöperation of dentists and nurses; and enlisting the interest and services of all medical, dental and pharmaceutical schools, societies and journals.

The law-enforcement measures include encouraging the closure of restricted districts; stimulating enforcement by State and municipal officers of laws and ordinances directed against prostitution in all its phases; establishing and managing institutions for the rehabilitation of venereally infected persons and committing to institutions venereally infected feeble-minded persons; urging the adoption and enforcement of laws and ordinances compelling the reporting of venereal diseases, the prohibiting of quack advertising and the sale of venereal disease nostrums.

The educational measures include the dissemination of information by means of leaflets, lectures, moving pictures, etc., among industrial plants, commercial institutions, clubs, libraries, schools and churches.

Some of the leading medical journals have discussed this Act in their editorial columns, notably the *Journal of the American Medical Association* and the *Boston Medical and Surgical Journal*.

Walter Den Bleyker⁴¹ describes the treatment given patients under State control at the Fairmount Hospital, of Kalamazoo, Michigan; and G. F. Inch makes a report concerning the mental condition of those

⁴¹ Journal of the Michigan State Medical Society, April, 1919.

patients. Regarding the former article, it may be stated that the gonorrheal patients were subjected to treatment for one month before bacteriological examinations were made with the view of determining whether the infection had been overcome. As indicative of the uncertainty of such examinations, it may be noted that in this series of cases the smears from many patients were negative on four successive occasions, only to become positive when the fifth smear was made. This is quite in accordance with the findings in private practice. Indeed, it is well known that bacteriological examinations of secretions known to have conveyed gonorrhea to the male may prove repeatedly negative for the gonococcus. The infection, however, is present, even though it cannot be demonstrated in the laboratory.

Den Bleyker's method of treatment consisted of douches, local applications and vaccines. Douches of 1.5 per cent. cresol followed by 1 to 1000 potassium permanganate were given twice daily. The direct applications to the cervix and the vault of the vagina were made every second day. For this purpose a 3 per cent. tincture of iodine was employed. On the same occasions a urethral injection of 2.5 per cent. protargol solution was given. The gonorrheal vaccine was given every five days. Treatment of the syphilitic cases consisted in the usual administration of salvarsan and deep injections of salicylate of mercury.

Dr. Inch's report, although interesting, throws no new light upon the mental condition of patients of the class under treatment. As is well known, at least 50 per cent. of prostitutes are mentally deficient. In this series of 139 cases in which the Terman or Yerkes-Bridges tests were applied, 41 per cent. were morons or imbeciles. In addition, a considerable number were found to be what the author calls mentally dull; that is, they were on the border-line of abnormality. While not all the women examined could be considered prostitutes, the majority of them undoubtedly were. Three of the morons were epileptic and three others had general paresis. Forty-nine of these patients gave a definite history of syphilis. The author states that to the casual observer, many of these women presented a normal appearance, being neat in their dress, having a good memory, and possessing considerable acumen in regard to their own welfare. They, however, lacked comprehension and judgment, and were abnormally suggestible.

From the sociological point of view, the method employed at the Pennsylvania Hospital, where a clinic for syphilis has been held since 1911, may be of interest. It has recently been described by Newcomer, Richardson, Ashbrook and Lewis.⁴² The patients, who are referred from different branches of the Out-patient Department, are under the observation of a social-service worker, who devotes her whole time to them. Her duties consist in instructing them concerning the gravity of their disease and the necessity for regular and prolonged treatment; investigating their pecuniary condition; looking them up when they fail to come back at the specified time; and advising and helping them in every possible way. Naturally, in a mixed service, in which a consider-

⁴² American Journal of the Medical Sciences, August, 1919.

able proportion of the male patients are employed and making fair wages, the duties of the social service worker will be confined to the female contingent. The authors state that relatively few of the women treated are single, and that about one-fourth of the entire number are the wives of men who have been treated in the clinic. Only a small percentage is made up of professional prostitutes; and of this number, the majority have come only two or three times, and have then been lost sight of. It is this class that the social service worker has had most difficulty in locating. With regard to the very poor, they have been found lazy and indifferent; and, like the prostitutes, have usually disappeared after a few treatments. The authors conclude that unless they are in the infectious stage of their disease, it seems a waste of time to try to do much for them. The price charged for the salvarsan is now four dollars per dose, a sum that experience has shown inflicts no hardship upon the average patient. Some persons, however, have received it gratuitously, the free service constituting about 10 per cent. of the whole.

Several tables are appended to this article, the most interesting of which—to the reviewer, at least—is one that deals with the economic aspect of the subject. This table shows the earning capacity of twelve patients, the amount of time that they have lost as the result of their disease, the cost of their treatment, and the amount of money saved them through the treatment received. It demonstrates that treatment costing them \$81.00 saved them \$1080.00 in earning capacity and one year of time.

The experience of the authors has convinced them that it is practicable for any well organized general hospital to establish a clinic for the treatment of venereal diseases without any great expense to the institution, and to the certain advantage of the community it serves.

Anesthesia in Genito-urinary Work. Spinal anesthesia continues to occupy the attention of genito-urinary surgeons; and, from time to time, a contribution to the subject appears. Two such that have recently come to my notice are those of Smith and Allen, of Boston, and Dakin,⁴³ of Los Angeles, the former summarizing their experience with the method at the Massachusetts General Hospital, and the latter rather laying stress upon the indications and contra-indications for the method.

Smith and Allen state that they routinely employ spinal anesthesia for prostatectomies, both suprapubic and perineal; and that they use it in urethrotomies, when there is evidence of involvement of the kidney. They also favor it for operations upon the bladder when there are serious concomitant circulatory or renal symptoms; although they point out that in such cases an objection to its employment is the necessity of placing the patient in the Trendelenburg posture, which favors a diffusion of the anesthetic to higher levels of the cord. For cystoscopy a bladder that is acutely inflamed, they consider it the ideal method, as it gives perfect relaxation and does away with all pain from distention of the viscus.

⁴³ Urologic and Cutaneous Review, November, 1918.

During the last three years novocain and adrenalin have been used. At the time their communication was presented, however, the authors had begun to use apothesine, a preparation having the same formula as "Tablet C" novocain. Both contain a minute quantity of suprarenal gland. In their first 200 cases novocain was used. With regard to the concentration of the solution to be employed, the opinion is expressed that the most satisfactory for general use is one that contains 5 cg. of the drug to 1 c.c. of fluid.

The after-effects as observed by these authors may be summarized as headache, localized paralysis and aphasia. The headache occurred in about 20 per cent. of their patients, and in some cases it lasted for two weeks; as a rule, its duration was not more than three or four days. They have not had any deaths.

Dakin's paper is more in accordance with the opinion expressed by the reviewer when discussing this subject in a previous issue of *PROGRESSIVE MEDICINE*. Dakin states that the method should never be resorted to for a patient who can take a general anesthetic. I have had no reason to change my opinion, previously expressed, that there are very few patients who cannot take ether, when it is given by a competent anesthetist who uses the drop method. I have never used spinal anesthesia for any operation whatsoever, either in genito-urinary or in general surgery.

Nausea and vomiting have been noted by Dakin, in addition to the symptoms reported by Smith and Allen. He attributes them to lowering of the blood-pressure, and states that they have been controlled by the hypodermic administration of strychnia and adrenalin.

As contra-indications, this author mentions an unusually low blood-pressure, especially in patients of advanced years; pericarditis; pleural effusions or anything interfering with the action of the heart; anything that interferes with diaphragmatic breathing, such as ascites or tumor; cerebrospinal disease, and great nervousness.

The author's concluding statement, to the effect that no surgeon would prescribe spinal analgesia for himself except in the presence of an absolute contra-indication to a general anesthetic, is well worth thinking about.

An interesting report on the employment of local anesthesia in renal surgery has been made by Robert E. Farr,⁴⁴ of Minneapolis; and although I am not likely to adopt the method, yet I think it worthy of mention in this review. That Farr is familiar with the attitude of the average surgeon in regard to the matter, is shown by a statement he makes to the effect that at the present time kidney operations done under local anesthesia are looked upon as "surgical stunts" which are practised only by the local-anesthesia enthusiast. The author, however, is satisfied with the method, and has obtained good results from its employment. Consequently, it is not to be criticised in his hands. Perhaps the temperament of the individual surgeon is a factor that must be taken into consideration. Certainly it is not every operator who has the

⁴⁴ *Urologic and Cutaneous Review*, February, 1919.

patience to infiltrate the tissues with 8 ounces of fluid, as is done by Farr. He states that blocking of the nerves close to their exit from the spine and an infiltration sufficient to build a wall of anesthesia between the central nervous system and the kidneys are the only methods that will prove satisfactory. In an area as large as that which is laid bare in the average kidney operation, it is evident that a considerable quantity of the solution must be used. The infiltration method is given preference. Farr uses the pneumatic injector equipped with long, fine needles, the needle being kept constantly moving, and the solution being made to flow steadily in a uniform stream. Thus what is called the "change of pace," from sticking of the plunger in the syringe, is avoided.

In addition to a number of nephrectomies, the kidney has been split open, the pelvis incised, and the ureter likewise exposed and opened, so as to permit of the extraction of a calculus. As might be expected, not all of these operations were performed without causing the patients pain; but during the last three years, so the author states, he has been able to deliver the kidney without causing the patients any distress. He mentions one case in which a kidney as large as a cocoanut was removed, and the patient experienced no pain until the renal vessels were clamped. In two other cases pyocalculus kidneys were removed. In one case the peritoneum was opened posteriorly and the appendix taken out.

From his experience with the method, the author is convinced that all patients requiring a kidney operation who have serious cardiorenal symptoms should be operated upon under local anesthesia.

Maxeiner, Farr's associate, has made a comparison of the output of urine, as well as its pathological content, in a series of 300 cases done under ether and 300 done under local anesthesia with novocaine. In the former, a trace of albumin was found in over 80 per cent.; whereas, in the latter, it was very rare—although the author does not state the exact percentage in which it was present. In like manner, while he states that the excretion of urine was invariably diminished during the first twenty-four hours after operations upon patients who had ether, he does not state that it was not lessened in those who had novocaine.

In summarizing the method, the author defines three factors that are necessary for success; namely, a sufficient quantity of novocaine used in the right area and in the right manner; a free exposure of the operative field, with a division of one or more ribs, if necessary; a delicate handling of the tissues, and sharp dissection with a knife or scissors, instead of blunt dissection with fingers or gauze.

In this connection, a statement by W. Hamilton Long,⁴⁵ of Louisville, who contributes a paper upon General Anesthesia in Genito-urinary Surgery, is of importance. Long states that he has given ether to several scores of patients suffering with chronic nephritis, and even with a sub-acute inflammation, without having had a single mortality that could be attributed to the anesthetic; and, furthermore, that he has never seen a complete suppression of urine with a fatal uremia from the administration of ether. On two occasions, however, he has seen this sequel

⁴⁵ Urologic and Cutaneous Review, February, 1919.

follow the use of chloroform, which formerly was thought preferable to ether in cases of renal disease. Long considers nitrous oxide and oxygen the anesthetic of choice in cases in which it is essential to avoid inflicting any extra work upon the kidneys. Probably the greatest criticism that could be brought against this combination is the fact that it is not always possible to secure complete relaxation with it. Long likes to supplement it with a little ether. Many surgeons will agree with him in the opinion that prolongation of an operation is frequently a greater factor in the production of shock than is ether.

In discussing anesthesia for prostatectomies, Lillian B. Mueller,⁴⁶ of Indianapolis, gives the preference to nitrous oxide and oxygen, which she has found to be entirely satisfactory, and which she considers to be the one safe anesthetic for this class of cases. Blood-pressure tracings have shown that there is very little change in systolic pressure under nitrous oxide-oxygen anesthesia, which shows that the old teaching about its being so unsafe in arteriosclerosis may require modification. Dr. Edward Martin, of Philadelphia, has long contended that nitrous oxide can be given with safety to old patients who have sclerosed blood-vessels and, consequently, high arterial pressure.

Half an hour before starting the anesthetic, an injection of $\frac{1}{6}$ or $\frac{1}{4}$ grain of morphine is recommended by Mueller. Formerly she combined it with $\frac{1}{150}$ grain of scopolamine; but, as certain patients showed an idiosyncrasy to the latter drug, its use was discontinued. Some of the patients were delirious for twelve or even twenty-four hours. Chloroform is debarred in this class of cases on account of the danger of fatty degeneration of the viscera which it entails, and also because of its depressing action upon the circulation. The objection to ether, according to Mueller, is its irritating effect upon the kidneys and its liability to precipitate an acute bronchitis, or even pulmonary edema, in those patients, unfortunately not uncommon, who suffer from chronic bronchitis.

Gonorrheal Keratosis. Another case of keratosis has been reported by Norman P. Laing,⁴⁷ which is interesting because the eruption not only involved the trunk and the limbs, but also affected the mucous membrane of the mouth, as well as the coronal sulcus and the anal region; and likewise, because the lesions resembled those of secondary syphilis combined with keratosis. The patient was admitted to the hospital with an uncomplicated anterior urethritis of three days' duration. On the eleventh day, a posterior urethritis developed, and twenty-four hours later an arthritis manifested itself in the right knee. During the following week both knees and ankles were involved. On the seventeenth day after the onset of the arthritis, moist papules were discovered behind the corona and around the anus. Patches also appeared on the mucous membrane of the cheeks and on the lips. These looked like specific mucous patches. The next day some small bullæ were noticed on the soles of the feet and on the legs. In a few days they became cornified. Similar lesions developed later on the thighs, abdomen and chest wall,

⁴⁶ Urologic and Cutaneous Review, July, 1919.

⁴⁷ Lancet, March 8, 1919.

as well as on the arms and hands. At this time the diagnosis of keratosis had been easily made, but the lesions on the penis, around the anus and in the mouth were still considered syphilitic. The blood test, however, was negative. The same result was obtained after a provocative dose of novarsenobenzol had been given. The eruption gradually subsided, and the patient's general condition at the end of a month was such that he was allowed to get up and walk on crutches. Urethral irrigations and prostatic massage brought about sufficient improvement to permit of his being able to go to a convalescent depot at the expiration of another three weeks.

Gonorrheal Empyema. Among the rarer complications of gonorrhea is empyema, of which, according to Norris, only 16 authentic cases had been reported up to May, 1913. Recently a case has occurred in the practice of H. S. Woodbery,⁴⁸ of Charlottesville, Va. It was that of a female child, aged eight years, who was admitted to the hospital for abdominal symptoms of five days' duration. Upon admission, she had a temperature of 103.4° F. and leukocyte count of 28,000. A diagnosis of general peritonitis, probably due to rupture of the appendix, was made, and the abdomen was immediately opened. Very little was found wrong with the appendix; but it was assumed that some form of streptococcus had affected it, and had passed through its walls without making a perforation. On the sixth day after the abdominal operation, the patient developed signs of right-sided pneumonia and pleurisy. Aspiration of the pleural cavity yielded 2 c.c. of thick yellow pus. This operation was followed immediately by resection of a rib, whereupon more pus, of the same character, was obtained. Smears of the pus from the pleura showed a microorganism which corresponded in every respect to the gonococcus, although it was impossible to reproduce it by culture. As a profuse vaginal discharge containing gonococci was discovered on the second day after the abdominal operation, it was assumed that the abdominal symptoms, as well as those referable to the pleura and lung, were due to the specific microorganism of Neisser. The child died twelve hours after the second operation, but no autopsy could be obtained.

⁴⁸ Surgery, Gynecology and Obstetrics, December, 1918.

SURGERY OF THE EXTREMITIES, SHOCK, ANESTHESIA, INFECTIONS, FRACTURES AND DISLOCATIONS, AND TUMORS.

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THE time which has elapsed since the signing of the Armistice and the cessation of hostilities has not been sufficient to provide the perspective necessary for a final review of the surgical progress during the late European War. Each succeeding year, since 1914, as the knowledge of the principles underlying Military Surgery has developed with increasing experience, the yearly reviews have of necessity expressed what have been apparent contradictions. After four years, the danger of premature conclusions should at least be lessened, but there is still a wide difference of opinion as to the interpretation of certain surgical phenomena and their treatment, and the necessity for caution still exists for the reviewer. However, it is not only our duty at this time to present the best of the surgical literature which has appeared but also to discuss its bearing upon the vital principles of surgery, and from the practical aspect, the permanent effect this military experience will have upon civil surgery.

Bottomley,¹ in his Chairman's address before the section of Surgery of the American Medical Association, says "that during the war no entirely new surgical principle was uncovered. But in this fact there is no discredit to surgery, since it is equally true that the long-established principles on which surgery rests emerged triumphant from a test, the equal of which they will never meet again.

"The practice of the principles of asepsis and antisepsis was at first rudely shaken. The novelty of it all, the conditions of time, soil, movement, equipment, both human and material, the number of wounded, their uneven distribution, the multiplicity, extent and severity of their lesions, the virulence and rapidity of the development of the infections, seemed for a time about to overwhelm our methods of surgical practice. But Pasteur and Lister builded for all time, and at no period of the war were the truths and the principles of asepsis and antisepsis in veritable danger." As the months passed, the experience obtained from the care of enormous numbers of massive traumatic wounds with infection of overwhelming virulence served to present the problem of surgical infection in such an exaggerated way that finally the etiological factors were understood. When it was appreciated that they were exactly the same factors as those causing infection in traumatic wounds of civil life,

¹ Journal of the American Medical Association, June 21, 1919, No. 25, lxxii, 1802.

differing from them only in degree, the necessary basis was provided for the rational treatment which was developed. By changes in the organization of the medical forces and of the operative technic, it was possible to minimize, and often eliminate, the military conditions which magnified the cause of infection in the war wounds, and whenever this was possible it was found that these wounds responded just as satisfactorily to the surgery of war life as did civil wounds before the war. Indeed, toward the latter months of the war, far better results were obtained than we had dared to hope for in the past. This subject will be considered in detail under wound treatment and wound infection.

Pilcher² expresses the same opinion in the following way, "Without in any way belittling the extraordinary results which have been attained in the surgical efforts of this world's war, is it not true that in general these results are but demonstrations and applications, though often upon a colossal scale, of principles and truths which the work of the previous fifty years had been accumulating, rather than the development of any new and important principle which, with the disappearance of the special conditions of combat destructiveness, will remain to us as a permanent addition to surgical practice to modify the surgery of civil life hereafter?" Blake,³ one of the few American surgeons who has had the privilege of active military service throughout the war, when speaking at the Sorbonne, April 1, 1919, confesses to a feeling of disappointment in regard to the influence which the experience derived from the observations of the treatment of wounds during the war has had upon the development of surgical science. "There has been little new in the knowledge we have obtained. There has rather been a confirmation of principles already known, and the progress that has been achieved has been principally in stabilizing treatment rather than in making discoveries."

All military surgeons are agreed that distinct progress has been made in the surgical treatment of wounds. DePage,⁴ in speaking before the American Surgical Association, said, "The important scientific contributions which have been produced in the course of the war have impressed upon the treatment of wounds a new evolution which will make an epoch in surgery." In military surgery, the problem of wound infection was paramount, and the civil surgeons who had been relegating his few infected wounds to the tender mercies of the House Surgeon, and he in turn to the nurse, soon found the accepted treatment totally inadequate. The result has been an intensive study of the problem of wound infection, and at the close of the war a new epoch in the treatment of traumatic wounds had begun. Few will dispute that this is the most important development from the surgical experience of the war.

That the prophylactic value of antitoxin was proven in tetanus is indeed a great contribution. No opportunity for such a test has occurred before, and it has not only been the means of saving lives during the war but will continue to be of inestimable value in the future.

Blake feels that the war has contributed greatly to our knowledge

² *Annals of Surgery*, June, 1919, No. 6, vol. lxix.

³ *Ibid.*, May, 1919, No. 5, vol. lxix.

⁴ *Ibid.*, June, 1919, No. 6, vol. lxix.

and understanding of the condition known as surgical shock. The conflicting theories which have been evolved by those engaged upon the problem would suggest that hypothesis (and not knowledge) or understanding is what we really possess, but if we cannot call it knowledge a "working hypothesis" has been presented, especially by Cannon, which has made possible a rational and effective treatment. "The use of external heat, the infusion of alkaline solution, the transfusion of blood, were not new but were so emphasized by these hypotheses that new faith was created in their efficacy and surprisingly improved results were obtained."

Much study was given to the different anesthetics, and particularly to their effect upon shock. "The consensus of opinion is that probably nitrous oxide with oxygen will be employed in future to the exclusion of other general anesthetics except ether, which will be used as an adjunct."

"One of the most striking observations (Blake) was in regard to wounds opening the pleural cavity." The so-called sucking wounds—with such a wound a man got along fairly well for a time, and then went rapidly into shock and died. To a lesser degree all surgeons have observed this phenomenon when producing a rapid pneumothorax by resecting a rib. The explanation, which has been so conclusively demonstrated experimentally by Bell and Graham,⁵ is respiratory failure, asphyxiation, or a lack of oxidation and death from shock. By closing these wounds, it was found that shock could be prevented, and this fact gives cause for thought when the surgeon is called upon to drain a pleural cavity in which there are no adhesions to prevent pulmonary collapse.

In the treatment of fractures, particularly compound fractures, no one can deny that improvement has been developed. To no one more than Blake is this improvement due. At the outbreak of the war, immobilization was the cardinal principle of treatment. The stiff joints encountered in civil life, where the vast majority are simple fractures and the period of fixation is short, are easily overcome, but the stiff joints resulting from the long periods of immobilization necessary for the compound fracture of war were often more disabling than an ununited fracture or an amputated hip. Blake's principle of applying traction to the distal fragments of the bone in the direction of its axis, when the limb is in the position of rest, has given the best results obtained in the compound fractures of this war and this should be applied in the treatment of fractures in civil life.

In the surgery of the joints, the two great advances are the knowledge that the synovial membranes possess greater self-protection against infection than we had imagined in the past, and the corollary to this is Blake's principle of preservation of function and Willems' treatment of wounds of joints.

Thus DePage⁶ points out that "Willems, cutting loose from prejudice,

⁵ American Journal of the Medical Sciences, December, 1918, Nos. 6 and 561, clvi, 839.

⁶ Annals of Surgery, June, 1919, No. 6, vol. lxix.

replaced classic immobilization of joint infections by active mobilization. The movements to which a joint is subjected when they are executed by the patient are not painful, and the results produced by this mode of treatment are really remarkable. The suppuration diminishes rapidly, infection disappears, and the joint mobility is preserved, even when infection has been profound, with considerable tissue destruction."

From the war experience another definite change in our surgical treatment of traumatic wounds will be in the practice of drainage. Whether they involve soft tissues, bone, the serous cavities of the pleura, abdomen or joints, it has been shown that in the past "drainage has been overdone and it is better to thoroughly cleanse and sterilize a contaminated wound and close it than to drain. Instead of following the old rule 'when in doubt, drain,' the new rule will be 'when in doubt, don't drain.'"⁷

Blake⁸ states "that in order to form a just opinion, however, as to the influence of our military experience upon surgical science as a whole, we must place on the other side of the balance those developments which may exert a harmful influence in the future. Happily, these are chiefly habits or practices engendered by the stress and unavoidable cruelty of war, and which will disappear under the softening influences of peace. The courage and the spirit of personal sacrifice evoked are uplifting, but, on the other hand, there is much that is depressing and demoralizing, especially to the surgeon. Besides the long periods of enforced idleness, there is always the eternal conflict with the insuperable conditions imposed by the war." (With the too frequent enforced and unsatisfactory compromise of surgical principles.) "The ordinary soldier is impressed by the dirt and everlasting discomfort; the surgeon is more likely to be overwhelmed and his morale shattered. Overcome by the difficulties with which he is surrounded, the impossibility of surgical cleanliness, the masses of the wounded, he becomes indifferent and callous; he no longer strives for the ideal. If, in addition, he sees his results ruined and his patients lost through official stupidity, this attitude of mind is more than likely to be confirmed. In reality, it requires exceptional strength of character to come through such experiences without deterioration."

Shock. The conflicting character of the many explanations of shock which have been offered during the last year, especially by those working overseas, would indicate that theory instead of knowledge has been contributed. That some of the confusion is dependent upon an uncertain definition of the condition is evident in the literature. "If shock be considered as a general body condition in which the central fact is 'circulatory failure,' as suggested by Cannon,⁹ then psychic shock, wound shock, toxic shock, septic shock, peptone shock, and the shock following hemorrhage all have in common the condition of circulatory failure. The classic symptoms, which Cannon¹⁰ includes in his defini-

⁷ Mayo, Wm. J.: *Collective Papers*, Mayo Clinic, 1918, vol. x.

⁸ *Annals of Surgery*, No. 5, lxi, 464.

⁹ *Journal of the American Medical Association*, July, 1919, No. 3, lxxiii, 177.

¹⁰ *Loc. cit.*

tion of traumatic shock, are present in all these various types in a direct proportion to the degree of circulatory failure which exists."

TRAUMATIC SHOCK, as defined by Cannon, Cowell, Frazer, Hooper,¹¹ and Cannon¹² "is a general bodily state occurring after severe injuries and characterized by persistent low arterial pressure, rapid pulse, pallor or slight cyanosis, sweating, superficial rapid respiration, and usually dulled mental condition. There is found in this state a concentration of the blood corpuscles in the capillaries, and a reduction of the alkali reserve in the blood which corresponds in a general degree to the lowering of the arterial pressure."

Circulatory failure of this kind, of course, follows hemorrhage, infection and psychic injuries. Where there is an actual loss of blood volume, as in hemorrhage, this circulatory failure can be readily understood, but that the same symptoms are encountered in traumatic wounds where hemorrhage is absent, and in infection and psychic injury as well, suggests "that an unknown factor is at work."

Studies of the circulatory failure following traumatic wounds in which the factor of hemorrhage and actual loss of blood volume has been eliminated, suggested to Cowell¹³ to differentiate between primary and secondary wound shock. "In primary wound shock, death is certain to occur early because of the severe anatomic damage." That this type of shock may occur without severe hemorrhage is unquestionable, and, in these cases, from the earliest moment there is a low blood-pressure. Such primary wound shock is not uncommon in civil surgery, especially in industrial accidents. Crile's¹⁴ suggestion of traumatism to the nerves may be the explanation for this type of shock. There is, on the other hand, a state of wound shock which, instead of coming on immediately after the injury, comes on after a few hours, and this Cowell calls "secondary wound shock." From the outcome of experiments there was justification in reaching the conclusion that this type of wound shock was the result of a substance which lowered blood-pressure passing from the traumatized region to the rest of the body by the way of the circulation. Dale and Laidlaw¹⁵ have shown that a characteristic shock-like condition can be induced by the injection into the circulation of extremely minute quantities of *histamin* (a substance which they obtained from the small intestines). Abel and Kubota¹⁶ have obtained histamin from mutilated tissues and find that it is the most powerfully acting of the depressing substances which have their origin in devitalized tissues, and suggest that it may play the leading role among the chemical factors concerned in traumatic shock. The low blood-pressure caused by this chemical substance has been shown to be due to a dilatation of the capillaries and the escape of the blood plasma into the tissues—Dale and Richards.¹⁷ This effect is in accord

¹¹ Journal of the American Medical Association, February 23–March 2, 1918.

¹² Ibid., July 19, 1919, No. 3, lxxiii, 174.

¹³ Ibid., March 2, 1918, lxx, 607.

¹⁴ Ibid., July 19, 1919, No. 3, lxxiii, 179.

¹⁵ Journal of Physiology, December, 1910, xli, 318 and 499; January, 1911, xliii, 182; October, 1911, lii, 355; March, 1919.

¹⁶ Journal of Pharmacology and Experimental Therapeutics, Baltimore, June, 1919, No. 3, xiii, 243.

¹⁷ Journal of Physiology, July, 1918, lii, 110.

with the clinical evidence of diminished volume of circulating fluid and concentration of the corpuscles in the capillaries which Cannon¹⁸ and his co-workers have reported. From clinical experience, Delbet¹⁹ and Quenu²⁰ have independently come to the conclusion "that the phenomena of secondary shock are the consequence of absorption of proteolytic products arising from the region of the injury." They suggested the possibility that this traumatic toxemia may be closely related to "PEPTONE SHOCK" and that the toxic agent is like peptone, capable of making the capillary wall more permeable to the fluid portion of the blood. Thus the clinical inference and the experimental facts agree as to the possibility of circulatory failure being caused by the action of the chemical substances absorbed from dead and devitalized tissues and, in this *toxic circulatory failure*, the decreased circulating blood-volume is the result of the escape of blood-plasma into the perivascular tissues, and though there is no actual loss of blood from the body, as in hemorrhage, the physiological result, if the arterial blood-pressure were the same, would probably be the same.

The physiological result of the fall of blood-pressure and decreased circulating blood volume is essentially a decrease in the oxygen-carrying capacity of the blood stream and hence an insufficient supply of oxygen is furnished to the tissues. It has been found experimentally²¹ that there is a critical level in the blood-pressure, 80 to 90 mm. of mercury, below which it cannot fall without bringing about a change in the alkali content of the blood. This condition of acidosis is an indication of insufficient oxygen content and is not of itself, as was first believed by Cannon, harmful. Thus, after the blood-pressure has once been lowered, whether by the actual loss of blood-volume, as in hemorrhage, or by the relative loss of blood-volume, as in toxic and psychic shock, the effects on the organisms are similar. The dictum of the older surgeons "that shock is hemorrhage and hemorrhage is shock" is thus justified.

The following working hypothesis can, I think, be suggested at this time. Upon it was based the treatment of shock, in the American Expeditionary Forces, and the results obtained were certainly a distinct advance over those of the early years of the war. The circulatory failure which exists in the indefinite condition known as shock is the result of the loss of blood-volume, actual in hemorrhage, and relative in psychic, septic and toxic shock. (The condition of exemia, as Cannon designates it, in which there is a temporary loss of volume of the circulating blood though not an actual loss from the body.²² The low blood-pressure results in a decrease of the number of circulating red blood cells which means a diminished oxygen supply to the tissues, and, as a consequence, highly sensitive structures, especially the nerve centers, are injured and their function impaired or destroyed.)

¹⁸ Journal of the American Medical Association, February 23 and March 2, 1918.

¹⁹ Bul. de l'Acad. de méd., Paris, July, 1918, lxxx, 13.

²⁰ Bull. et mém. Soc. de chir. de Paris, 1918, xlv, 496; Presse méd., February 7, 1918, vol. xxvi.

²¹ Cannon, loc. cit.

²² Journal of the American Medical Association, loc. cit., p. 174.

TREATMENT OF SHOCK. Cannon²³ suggests the following principles of treatment of shock:

1. Prevention of the absorption of the toxic products of dead and devitalized tissue in wounds by:

(a) Amputation or débridement.

(b) When the above is not possible the application of a tight tourniquet proximal to the involved area. Extreme care should be taken not to remove the tourniquet before operating upon a point proximal to it.

2. Warmth is universally recognized as of great value. As the blood-pressure falls, there is a marked diminution of heat production. The shocked man also sweats and thus loses heat by evaporation and by the increased conduction through his wet clothing.

3. Every effort should be made to prevent or overcome the damaging effects of low arterial pressure. If such simple measures as warm fluids by mouth and external heat do not in a half hour raise the pressure above the critical level of 80 to 90 mm. of mercury, it should be promptly raised by other means. The best method of raising the blood-pressure is transfusion of properly matched blood. In addition, not only is the pressure raised but oxygen carriers are added to the circulation. If blood is not available, Bayliss²⁴ advises that gum-salt solution may be employed. These colloidal solutions, if used early, can permanently raise arterial pressure. They do so by increasing the circulating volume of the blood. The corpuscles which are present are made to circulate more rapidly and thus to be employed more efficiently as blood carriers. This gum solution was used extensively in the American and British Armies, but from several hospital centers reports of alarming, and sometimes fatal, reactions following its use have been received. A satisfactory explanation of these reactions has not as yet been offered, and it will be necessary for civil surgeons to bear in mind this possibility. There is no evidence that either the subcutaneous or intravenous injection of physiologic salt solution has more than temporary value, if it has any beneficial effect at all.

Blood Transfusion. In reports to the Fourth Inter-Allied Surgical Congress, Govaerts²⁵ limits the indications for transfusion to: 1. The period immediately following injury, (a) traumatic shock, (b) subacute infection; and (c) hemorrhage.

2. During the period of treatment, to (a) secondary hemorrhage and secondary anemia; (b) infections.

He bases the diagnosis of severe hemorrhage upon three elements: The quantity of the blood; arterial pressure; and secondary anemia. The first two are difficult to estimate clinically, and in practice he has limited himself to the latter. If the number of red blood corpuscles does not exceed 4,000,000 in the first six hours, the prognosis is certainly fatal. Immediate transfusion is called for when there are less than 4,500,000 red blood cells in the first three hours; less than 4,000,000 red blood

²³ Loc. cit.

²⁴ Intravenous Injection in Wound Shock, London, 1918.

²⁵ Arch. de méd. et pharm. mil., Paris, 1918, lxx, 130, 145 and 158.

cells in the first eight hours; less than 3,500,000 red blood cells in the first twelve hours.

Tuffier says that he knows of no case in which a transfusion has remedied the effects of pure traumatic shock unassociated with hemorrhage.

Pemberton²⁶ reports the work of the Mayo Clinic, where the continuous and increasing application of transfusion is a strong proof of the permanent and wide value of this procedure. He reports a series of 1036 blood transfusions. The definite effects of transfused blood are: Restoration of the bulk of the circulating fluid; provision of oxygen and assimilable pabulum for the tissues; increase of the coagulability; stimulation of the hematopoietic organs; an increase of resistance to infection by its antitoxic and bacterial properties.

In the primary anemias, the majority of the patients, excepting those who had reached the last stage of the disease, received immediate benefits from transfusion, even the desperate cases for a time showed marked improvement. In the secondary anemias the majority were transfused preliminary to operation, with the idea of improving their general condition and thereby increasing their resistance to infection. Their experience, in cases of acute, frank, or concealed hemorrhage, as to the real value of this measure, is in accord with that of military surgeons. The indications for transfusion are not definite, but Pemberton's clinical observations bear out his belief that permanent degenerative changes occur in the organism when the exsanguinated condition persists for more than a few hours and he quotes Robertson's warning against using ordinary resuscitation measures before resorting to transfusion.

Their results of transfusion in weak, starved and anemic patients, as a supportive measure preliminary to operation, were evidenced by an increased ability to withstand operation and rapid post-operative convalescence. The results of blood transfusion in cases of jaundice, where the operative oozing is always a source of grave concern, has been good. Also in bleeding occurring after operations on the stomach and intestines, transfusion alone will often be followed by complete and permanent cessation of bleeding. The bleeding ulcers of the stomach and duodenum indicate transfusion preliminary to, or in association with, laparotomy for the excision of the ulcer.

He states that, clinically, the use of an anti-coagulant, as sodium citrate, in the transfused blood, not only does not retard the coagulability of the recipient, but possesses hemostatic power equal to that of undiluted blood. "According to Howell, the role of calcium in the phenomenon of coagulation is to activate prothrombin into the formation of thrombin (fibrin ferment), which in turn activates fibrinogen into fibrin. By the addition of citrate of soda, coagulation is prevented by the chemical immobilization or stabilization of the calcium without forming a precipitate. Excessive intravenous injection of citrate of soda deprives the blood and tissues of calcium, and the symptoms of

²⁶ Surgery, Gynecology and Obstetrics, March, 1919.

tonic and clonic convulsions, tetany, paralysis, and dyspnea are the results of the decalcification of the nervous system. There were 1001 transfusions by the citrate method.

The amount of blood to be transfused depends upon the age of the patient, the presence of physical impairments, such as cardiac lesions, arteriosclerosis, etc., and the condition for which the transfusion is indicated. Except for the purpose of replacing a large bulk of blood, the use of small quantities, 500 to 750 c.c., repeated in from five to seven days, gave the best results. In the selection of a donor, Pemberton's results seem to corroborate the observations of Peterson that the value of transfusion is largely dependent upon the individual donor. One blood may exhibit remarkable powers of hemostasis, another may induce hematopoietic stimulation, and that of another may exert real antitoxic effect.

Abelmann,²⁷ in order to avoid the coagulation when using the syringe method for transfusion of whole blood, suggests the use of an ointment containing sodium citrate. This ointment is composed of *adeps lanæ*, which is anhydrous, 10 parts; *aqua destillata*, 10 parts; *natrium citratis*, 10 parts; *petrolatum q.s. ad.*, 100 parts. The ointment, in addition to acting as an effective anticoagulant, prevents blood from intruding between the piston and the barrel of the syringe, thus preventing sticking of the piston. It possesses excellent lubricating qualities, but is sufficiently adhesive to cling to the syringe and needles without getting into the blood. The ointment is heated to a liquid state before applying to the needles and syringe. The incorporation of an anticoagulant in the paraffin coating of the various instruments which have been suggested for the transfusion of whole blood may solve a great many of the technical difficulties of the operation. And if it is possible to use the sodium citrate only on the transfusing instrument, and thus avoid introducing it into the recipient, it will be a great step in advance. It seems to be the general opinion of military surgeons that the best results were obtained with whole blood. The present citrate method is undeniably easier and usually more available than the whole blood, but that does not justify its use if whole blood is better. At the present time it does not seem that any of the methods in use in blood transfusion are entirely satisfactory, and, as the therapeutic value of transfusion has been definitely proved during the last three years, every effort should be made to perfect a simple and practical technic.

The Longitudinal Sinus for Transfusion in Infants. Fischer²⁸ advocates this procedure. The method is so simple, when compared to the difficulties encountered in trying to enter a vein the size of those in infancy, that even an inexperienced operator need not hesitate to try it. The sinus is also adapted for the abstraction of blood as in venesection during convulsions and for procuring sufficient blood in the most rapid manner for blood culture and the Wasserman reaction. He also suggests its use for the giving of salvarsan injections and antitoxic serums.

²⁷ *Surgery, Gynecology and Obstetrics*, July, 1918, xxvii, 88.

²⁸ *Medical Record*, September 1, 1918.

Technic. "The infant should be wrapped in a mummy bandage, well pinned so that the arms and legs are confined, and placed flat on its back on a table. The head should be steadied on both sides by an assistant while the needle is inserted into the sinus. As a rule, the sinus can be entered through the anterior fontanel up to the end of the second year. Anatomically, the sinus does not vary. It grows wider toward the back of the head, hence we should always utilize a point as far posterior as possible. As the needle is pushed through the posterior angle of the fontanel, it should be directed downward and backward in a line with the sagittal suture. The landmarks are positive, and, with but little practice, we cannot fail to enter the sinus. As the sinus lies very superficial, we need not go deeper than 1 or 2 mm. For this purpose, a needle one-half inch long of a 20- or 22-gauge, with a sharp point, is best adapted. For withdrawing blood, a Luer or Record syringe should be attached. As the needle penetrates the sinus, resistance is lessened, and we encounter the same sensation which we feel when the needle enters the dura in doing a lumbar puncture."

A Modification of the Moss Method of Determining Isohemagglutination Groups. Sanford,²⁹ because the iso-agglutins in the human serum are thermo-stabile, has tried to preserve the agglutinating properties of human serum by drying. He found that cover-slip preparations, dried in the air, wrapped in paper and placed in an ice-box, possessed marked agglutinating properties after two months. The value of this, in determining the group to which individuals belong, who are to be used as donors for transfusions is obvious. He suggests that this method of using dried serum should be employed in the following way:

The group in which a patient belongs might be determined by preparing the cover-slip and sending them to a laboratory equipped to make the necessary test. By dissolving the dried serum with a corpuscle suspension of a known group, the patient's group could be readily determined. The serum on the cover-slip is dissolved with one or two loopfuls of a suspension of group II corpuscles made by allowing two or three drops of blood from a group II person fall into 1 c.c. of a 2 per cent. solution of sodium citrate. Another cover-slip preparation may be made by dissolving the serum with a loopful of group III corpuscle suspension. Hanging drop preparations are then made and examined under the microscope. Agglutination of corpuscles on both sides places the unknown serum in group IV. No agglutination after ten minutes on either side places the unknown serum in group I. Agglutinations of the group III corpuscles and no agglutinations of the group II corpuscles place the unknown in group II, and agglutination of group II corpuscles and no agglutination of group III corpuscles places the unknown in a reciprocal group III.

Changes in Blood Immediately Following Transfusion. Huck,³⁰ in his investigation, performed transfusion by a modification of the citrate method of Lewison as described by Sydenstricker, Rivers and Mason.

²⁹ Collective Papers of the Mayo Clinic, 1918, vol. x.

³⁰ Bulletin of Johns Hopkins Hospital, 1919, xxx, 63.

They found that the RESPONSES TO TRANSFUSIONS were extremely variable.

Red Blood Cells: Generally, an immediate increase in the red cell count followed the injection of the blood which, in many cases, was apparently out of proportion to the quantity of blood introduced.

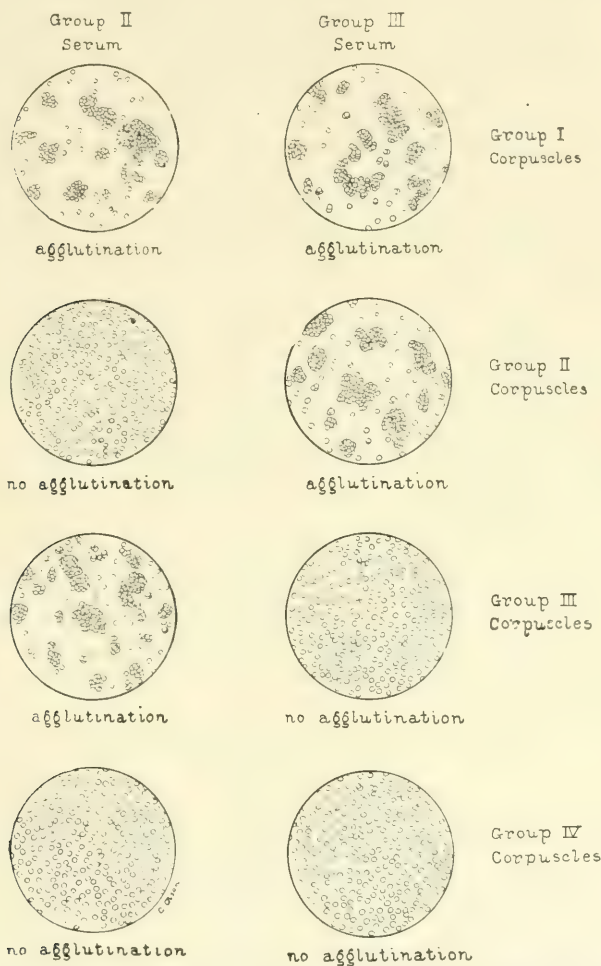


FIG. 55.—Appearance of hanging-drop preparations of corpuscle suspensions of four different groups (Moss classification) used to dissolve Group II and Group III serum dried on cover-slips.

Hemoglobin: The hemoglobin in most cases showed a uniform rise, reaching its maximum at the end of twenty-four hours. The variation in the color index showed that the hemoglobin changes were not parallel with the changes in the red cell count.

Leukocytes: There was some increase in leucocytes in nearly every case, though in some they remained stationary and in others fell. There was usually an increase in the polymorphonuclear neutrophils.

That there was no constant immediate change after the transfusion of blood in these cases would seem to indicate that no mechanical effects can be shown to follow the introduction of definite quantities of blood, but that the effect is essentially a biological one.

The Determination of the Length of Life of Transfused Blood-Corpuscles in Man. Ashby,³¹ by transfusing blood from a donor of a different group than the recipient, and then taking samples of the recipient's blood from time to time after the transfusion and differentially agglutinating the corpuscles, made an estimate, from the number of unagglutinated corpuscles present, as to the length of time the transfused corpuscles remained in circulation.

The following conclusions were drawn:

(1) In mixtures of corpuscles of different groups it is possible to separate the corpuscles quantitatively by treating the mixture with a serum that agglutinates the corpuscles of one kind and leaves the others unagglutinated.

(2) After a recipient has been given a transfusion of blood of a group other than his own, specimens of his blood treated with a serum that will agglutinate his corpuscles but not the transfused corpuscles, show the presence of unagglutinated corpuscles in large numbers.

(3) These unagglutinated corpuscles which appear in the recipient's blood after such a transfusion are the transfused corpuscles and their count is a quantitative indicator of the amount of transfused blood still in the recipient's circulation.

(4) The life of the transfused corpuscle is long, having been found to continue for thirty days or more. The beneficial results of transfusion are without doubt due primarily not to a stimulating effect on the bone-marrow, but, it is reasonable to assume, to the functioning of the transfused blood corpuscles.

PRE- AND POST-OPERATIVE CARE.

Suggestions for the Dietetic, Preoperative and After-care of Surgical Cases. F. L. Richardson³² maintains that the surgeon and anesthetist have their minds so carefully focussed on the technical procedures of the operation and the anesthesia, that certain other factors have not received the attention which they deserve. He refers particularly to the dietetic and medical preparation, and after-care of patients. He feels that diet has a definite influence upon postanesthetic vomiting, acidosis, and gas pains. The tradition that because vomiting followed the use of ether, therefore by giving no food or fluid they would have nothing to vomit, is certainly not true of fluids, as is now well recognized. He feels that it was a great step forward when it was found that water, either before or after operation, would not cause vomiting in itself, but rather decreased it. And he declares that it is now time to recog-

³¹ Journal of Experimental Medicine, 1919, xxix, 267.

³² American Journal of Surgery, April, 1918, No. 4, xxxii, 49, Anesthesia Supplement).

nize the fact that food, judiciously given, will also reduce the amount of nausea and vomiting.

The question of *acidosis* in relation to anesthesia is one of the most obscure in the whole realm of anesthesia. If the present belief is correct, the chemical substances which are concerned in the condition of acidosis come from the breaking down of fats. Normally, sugars assist in the catabolism of fats, and the concentration of fatty acids in the blood is never excessive. Where there is a deficient oxygen supply in the blood, or when the amount of available sugar is remarkably reduced, as in carbohydrate starvation, substances resulting from incomplete catabolism of fats are liberated in excessive amounts and excreted in a partly broken down condition. We find them in the urine as acetone, diacetic acid, β -oxybutyric acid, etc. With our present incomplete knowledge of the metabolism and physiology of anesthesia, we can do no more than theorize about the effects of inhalation of anesthetics upon these complicated processes. All the general anesthetics, except nitrous oxide, are fat solvents, and are absorbed by the fats of the body in a concentration dependent on the concentration of the anesthetics in the blood and the length of time the anesthetic has been given. In practice, the problem is still further complicated by a varying degree of starvation, and it is to this particular factor that he directs attention. What can we hope to gain by the proper attention to the dietetic preparation of the patient: (1) We can expect to maintain the nutrition of the patient at a higher level, thus conserving his strength for the operation and his recovery from the loss of blood and shock incident to the surgical procedure. (2) The diet for a day or two before operation should contain plenty of carbohydrates and sugars, a moderate amount of protein, and but little fat, in order to combat the post-anesthetic acidosis. (3) We can expect to have less discomfort from intestinal stasis and consequent production of gas. Alvarez³³ has clearly called attention to the direct relation between an empty gastro-intestinal tract and the formation of gas.

As to the after-care, Richardson suggests water, preferably hot, as soon as possible by mouth. When, for any reason, the patient has been on a restricted or improper pre-operative diet, the addition of sodium bicarbonate is beneficial, and should always be given to children who seem more prone to develop acidosis than adults. If diet has been restricted before, and cannot be begun immediately after, operation, nutritive enema of glucose should be given, remembering they should be accompanied by an occasional cleansing enema. That the intestinal trauma, which is one of the factors in the production of postoperative ileus and shock, can be definitely minimized, by using the Trendelenburg method of anesthesia, is suggested by Guthrie.³⁴ Placing the patient on the operating table in the Trendelenburg position before the anesthetic is started empties the pelvis of a surprising amount of small

³³ PROGRESSIVE MEDICINE, 1918, vol. iv.

³⁴ Journal of the American Medical Association, August 9, 1919, No. 6, lxxiii, 388.

intestine before the abdomen is opened. If, in addition, after the abdominal incision is made, two fingers of the right hand are inserted into the abdominal cavity and the abdominal walls lifted, the intruding air will cause any coils of intestine which have not gravitated out of the pelvis

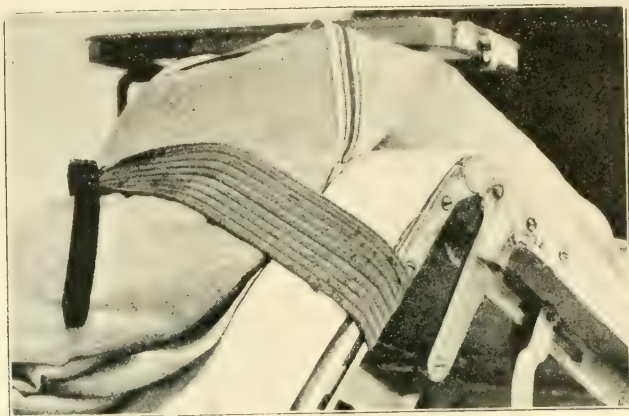


FIG. 56.—Patient's legs strapped to foot of table by a broad surcingle. (Guthrie.)

to slide upward so that it will usually only be necessary to employ one small gauze pad to get excellent exposure. This is not only a practical, but a timely, suggestion. The illustrations and diagrams are reproduced.

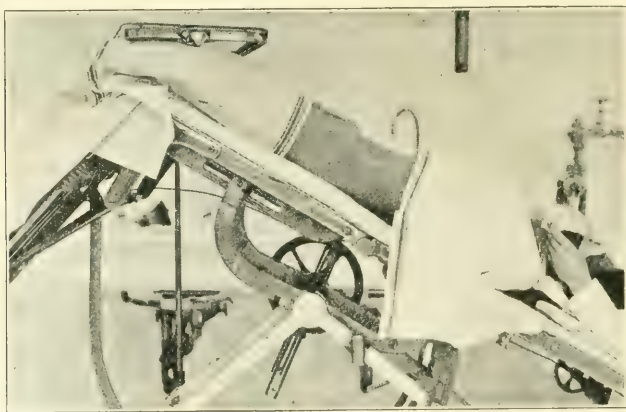


FIG. 57.—Anesthesia begun with patient in high Trendelenburg position. (Guthrie.)

Postoperative Pneumonitis. Cleveland, continuing the work of Whipple at the Presbyterian Hospital, New York City, upon postoperative pneumonitis, arbitrarily divides the subject into three types for purposes of study: (1) True postoperative pneumonia, often called ether pneumonia;



FIG. 58.—Lifting abdominal wall to free pelvis of any coil of small intestine. (Guthrie.)

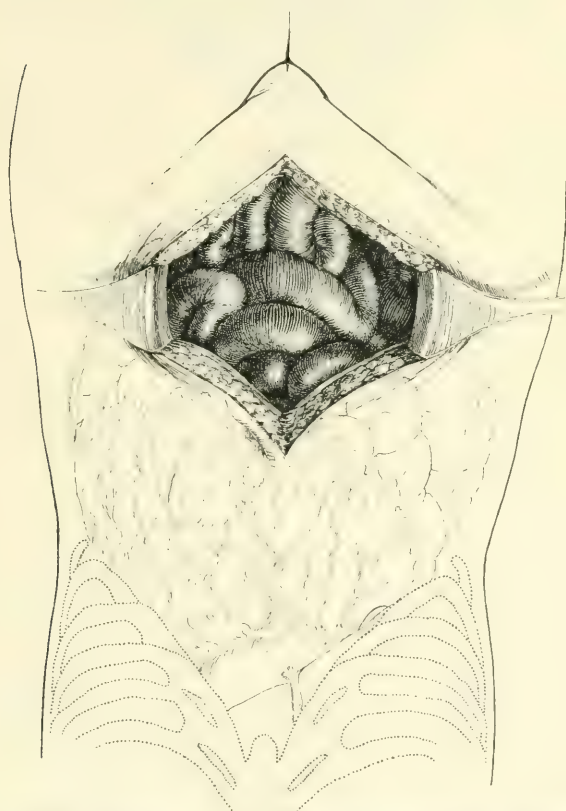


FIG. 59.—Compare difference in amount of small intestine in pelvis when patient is anesthetized in the dorsal position. (Guthrie.)

a disease coming on within the first few days after operation, accompanied by cough, rising temperature, and usually due to some exposure.

(2) Embolic pneumonia, occurring at any time after operation, and, so far as is known, one of the accidents of the postoperative course.

(3) Terminal pneumonia, occurring usually as an incident in patients *in extremis* after a short or protracted postoperative course.

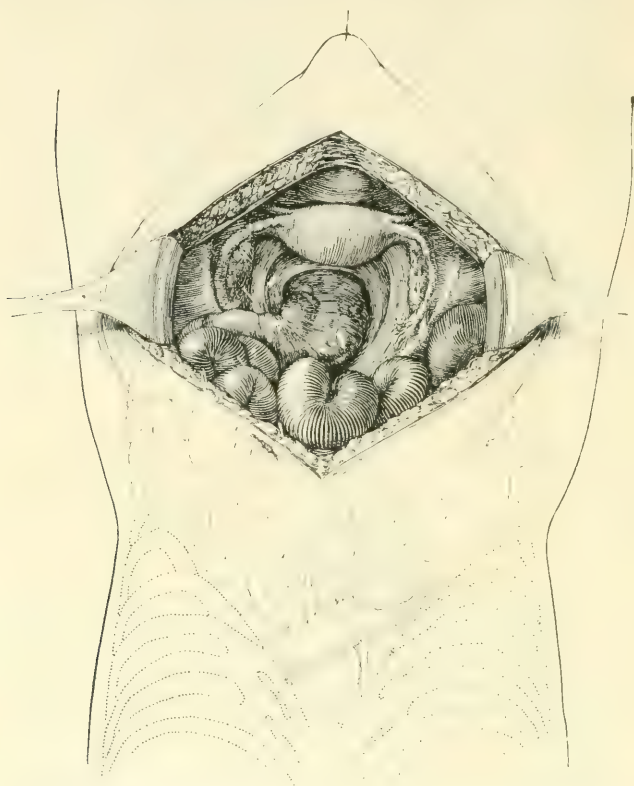


FIG. 60.—Trendelenburg anesthesia: Coils of small intestine gravitated out of pelvis when patient is anesthetized in this position. (Guthrie.)

In the 1940 operations studied during the year, there were 58 cases of postoperative pneumonia, and 7 of postoperative embolic pneumonia. This apparent high morbidity percentage, 3.3, is explained by the fact that every case with a temperature of 101° or over, without the presence of known infection, was carefully examined for pulmonary involvement and radiographed. As a result, there were no unexplained so-called "postoperative reactions," and the increased morbidity of postoperative pneumonia was really a tribute to greater diagnostic accuracy. Males developed postoperative pneumonias four times as frequently as females. Sixty-five per cent., or practically two-thirds of the cases, occurred during the winter and spring months. Among the predisposing factors,

he considers (a) coughs, colds, previous to or on admission to the hospital; exposure to the cold while in the hospital; (b) condition of the patient; (c) type of operation; (d) anesthesia. He concludes (1) coughs, colds and other inflammatory conditions of the respiratory tract are the most important factors predisposing to postoperative pneumonia. Restriction of abdominal respiratory movements as a result of incision, postoperative distention, tight dressings, is also a definite factor. He is convinced that the anesthetic *per se* does not cause the pneumonia, but the irritation of the anesthetic prepares the way for organisms already present in the upper respiratory tract by lowering the resistance of the lung tissue.

(2) Exposure of the patients to cold while in the hospital before, as well as after, operation, is responsible for a certain number of post-operative pneumonias.

(3) The pneumococcus group IV is most frequently the inciting organism of postoperative pneumonia.

(4) The urine of patients suffering from postoperative pneumonia frequently develops precipitins against the organism recovered in the pre- or postoperative sputum, while the blood develops agglutinins.

(5) The pneumonia due to pneumococcus IV is a definite clinical entity, differing from the pneumonia due to pneumococcus of groups I, II and III.

(6) The use of the roentgenogram in all cases of suspected post-operative pneumonia and a careful and constant search for physical signs will reveal more of such conditions than have hitherto been reported.

Anesthesia. The opportunities for clinical study provided by the war have been of just as great value to surgeons in their experience with anesthesia, as in their work with the problem of infection in traumatic wounds, the data obtained as a result of this experience will probably have as great an influence upon the future of anesthesia in civil surgery as will the advances made in the prevention and treatment of surgical infection. The majority of surgeons have expressed themselves in the many conferences in the war zone, and in the questionnaires which were sent out by the Research Society of the American Red Cross in November, 1918, as of the opinion that Nitrous Oxide Oxygen is the anesthesia of choice, though in the advanced area ether, from necessity, was the standard. Blake³⁵ says that "Much study was given to the effects of different anesthetics upon patients suffering from shock. Questionnaires and discussions at various meetings resulted in a consensus of opinion, which agreed with the laboratory findings, that all of the common general anesthetics—ether, chloroform, ethyl chloride and nitrous oxide—were harmful, but that nitrous oxide oxygen was by far the least dangerous. Although the harmfulness of general anesthetics was admitted, their replacement by local or regional anesthetics, except to a limited extent, was not considered practical or justifiable, and that the use of spinal anesthesia was not devoid of danger." Blake further

³⁵ Annals of Surgery, 1919, lxix, No. 5, 458.

states that, as a result of these experiences, "it is probable that nitrous oxide with oxygen will be employed in the future to the exclusion of the other general anesthetics, except ether, which will be used as an adjuvant."

That this clinical experience should show the alcohol group of anesthetics, ether, chloroform and ethyl chloride, to be more harmful in shock than nitrous oxide and oxygen, is entirely in accord with the recent theories advanced to explain that condition.

1. It has been shown that ether, chloroform and ethyl chloride are solvents of the body lipoids, and any interference with the normal process of oxidation of body fats would be expected to affect the alkaline reserve. Reimann and Bloom³⁶ found, as a result of observations upon a series of operative cases to which ether was given in the service of Dr. John B. Deaver at the Lankenau Hospital: (a) That the bicarbonate content (alkaline reserve) of the plasma was diminished in each case. (b) That there was an increase in the total acetone bodies (acetone, aceto-acetic acid, β -hydroxybutyric acid) in each case that would account for 60 per cent. of the bicarbonate fall observed. The cause of the remainder of the fall in the alkaline reserve was not determined.

2. With nitrous oxide-oxygen anesthesia, not only was this interference with oxidation avoided, but also it was possible, with the artificial supply of oxygen given, to maintain the oxygen content of the blood at, or above, normal, and thus prevent superimposing the acidosis of anesthesia upon that caused by other factors.

However, the armistice was signed long before the American Army was sufficiently equipped to make the use of nitrous oxide and oxygen a standard procedure. Ether was, of necessity, the anesthetic generally used and those of us who were forced to use the French or English ether can better understand why chloroform is so generally employed in those countries. At the American Ambulance we had many opportunities for comparing various makes of ether, and, in a general way, the American preparations were twice as effective as the French and English.

A number of anesthetists speak of the unusual quantities of all anesthetics which are required for operations upon soldiers a short time after battle. In our experience with the French, this same observation was made. The first explanation, that the French, being accustomed from childhood to a ration of alcohol, were less susceptible to the effects of the alcoholic anesthetics, was discarded when we found later that the American soldiers acted almost in the same way. We did not observe this, however, in our work in the cantonment hospitals on this side, during the days of mobilization and training, and it would seem probable that the nervous tension and excitement of battle may be an important factor in the amount required.

As a result of the Acapnia theory of Henderson, there had been a decided tendency for anesthetists during the years just before the war to employ rebreathing. The knowledge which military surgeons now

³⁶ Journal of Biological Chemistry, 1918, No. 36, p. 211.

have of the danger in decreased alkaline reserve in all operative procedure will in future prohibit any measures which increase the carbon dioxide content of the blood.

The literature contains very little about chloroform. The English and French used it, and in their hands it was much safer than with the Americans. With the Americans, apparently it was only used when ether was unobtainable. While on an inspection trip of small French hospitals, before America entered the war, a surgeon was asked if he had a sufficient supply of anesthetics. He complained bitterly of the lack of them and urged that we send him some chloroform. Having seen a rather generous lot of ether in the storeroom it was suggested that it be used, but he could not be persuaded to use ether for anything but cleaning and flaming his instruments.

A number of reports of the use of ethyl chloride have appeared from the English, French and American surgeons. Its portability, stability and simplicity of administration peculiarly adapt it to military surgery in the zones of advance. It has been used for operations of short duration not requiring muscular relaxation and to a less extent as preliminary to ether or chloroform. Boureaux³⁷ speaks of the following advantages:

1. Agreeable odor. 2. Rapid induction. 3. Rapid reaction. 4. Rapid elimination from the body. 5. Less nausea and vomiting and other post-anesthetic phenomena.

C. N. Coombs, J. A. M. A., Nov. 1, 1918, p. 1606, speaks of it as being invaluable in the rapid evacuation of patients in complete control of their faculties. The French have persisted in using it with a closed inhaler and Lortat (Paris Med., 1918, xxvii, 38) describes its adaptation to the apparatus of Ombredamme. The English, Canadians and the Americans have avoided the closed inhalers and dropped it on a thin layer of gauze held over the mouth and nose.

In a review³⁸ of the literature in 1908, it was found that the large majority of the reported fatalities followed its use by the closed method. Hagler and Bowen³⁹ report their experiences at a reserve German Hospital No. 5 at Grauditz. Upon taking charge, they found it was being used for all anesthetics. The dissatisfaction following their orders for its discontinuance made an explanation necessary, but they could find no evidence in the literature to support their feeling that it was dangerous. They limited its use to short anesthetics in which local anesthesia was not adapted. Their final conclusion "it can be safely given by unskilled persons" should not pass without a word of caution. Brown, of Providence, in a review of the reported anesthetic deaths, found that the mortality following the use of ethyl chloride and the use of nitrous oxide and oxygen to be about the same—one in three thousand.

The report⁴⁰ of its use at the Pennsylvania Hospital made in 1908, where it was first employed in this country as a general anesthetic and

³⁷ Bull. gén. de thérap., Paris, 1918, xxxii, 163.

³⁸ Lee: Annals of Surgery, November, 1908.

³⁹ Surgery, Gynecology and Obstetrics, March, 1918, No. 3, xxvi, 352.

⁴⁰ Annals of Surgery, November, 1908.

where probably they have had the largest experience with it, applies at the present time: "Though it seems impossible from available statistics to form an accurate estimate of its safety, any agent that will produce deep anesthesia in from fifteen to twenty seconds and whose danger signs are so difficult to recognize cannot be considered as safe as ether in inexperienced hands." Though the surgeons of the Pennsylvania Hospital still use it, they have the most wholesome respect of its danger, regarding it as a very sharp instrument which can only be trusted to a skilled anesthetist who has had considerable experience with it.

The *DePage anesthesia*, consisting of a mixture of ethyl chlorid, ether and chloroform, has received several favorable reports. In the questionnaire of the Research Committee⁴¹ of the American Red Cross, of 10 hospitals using it, but 2 condemn it. One, however, reports it as "No better than ethyl chloride." This same mixture was suggested by Willy Meyer⁴² and called by him anestol. A personal experience with this mixture at that time lasting over a year led us to nearly the same conclusion, "No better and probably a little more dangerous than ethyl chloride."

Local Anesthesia. REGIONAL. General Wallace⁴³ summarizes in a cryptic way the limitations of regional local anesthesia in war surgery. "Generally, local anesthesia takes too long to act. It has been used in conjunction with gas and oxygen in particular cases and is very useful in abdominal cases." However, its possibilities, when the proper conditions exist, necessary time and skill of the surgeon, have been demonstrated by the work of Bock with the Lakeside Unit and was reviewed in last year's *PROGRESSIVE MEDICINE*.

In answer to the questionnaire of the Research Society of the Red Cross, it is interesting to read the following report.

"In what cases and under what circumstances may local anesthesia be used? Regional? Spinal?

- | Local. | Regional. |
|--|--|
| 1. Selected head cases. | 1. Maxillo-facial surgery often. |
| 2. Thoracotomy. | 2. Operating in and about orbit. |
| 3. Dental surgery. | 3. Certain cases of skin graft. |
| 4. Small surface operations with superficial foreign bodies. | 4. In clean surface operations too extensive for simple local anesthesia where general anesthesia is contra-indicated. |
| 5. Face operations. | |
| 6. Secondary closures. | |
| 7. All chest wounds where general anesthesia is contra-indicated. | |
| 8. Selected abdominal cases. | |
| 9. Majority spinal cases. | |
| 10. Drainage of abdomen if general anesthesia is contra-indicated. | |
| 11. Many brain cases. | |
| 12. Superficial abscesses. | |

SPINAL.

1. In certain cases of shock, with gas oxygen or with morphine plus hyoscine.
2. Crushed legs plus bladder injury, if not too low blood-pressure.
3. Amputations of lower extremities in desperate cases.
4. Perineal wounds where general anesthesia is contra-indicated.

⁴¹ War Medicine, February-March, 1919, No. 7, vii, 1297.

⁴² Journal of the American Medical Association, 1903, ii, 28.

⁴³ War Medicine, American Red Cross, Feb. and March, 1919, vol. ii, No. 7, 1280.

Sollman,⁴⁴ in an experimental study of the comparative activities of agents commonly used for local anesthesia, has obtained some interesting and what should be very useful facts. He has found that cocain, novocain, tropacocain hydrochlorides, beta-eucain, holocain, alypin, quinin-urea, apothetin, antipyrin and potassium chloride vary greatly in their comparative efficiency according to the method in which they are used: (1) Surface application, (2) intradermal or (3) intraneural.

Surface Applications. The conjunctiva of rabbit's eyes were used in the experiments to determine the comparative efficiency. Presumably, the results would apply also to other mucous membranes, although this was not tested directly. The order of efficiency when applied to surfaces is markedly different from their use in conduction anesthesia (intraneural). Cocain is the most efficient, then holocain, beta-eucain, alypin, quinin-urea, tropacocain, and lastly novocain. The rapidity and duration of their action vary with the concentration. For just as effective concentrations, the duration is shortest with cocain and tropacocain, and longest with quinin-urea. The addition of sodium bicarbonate ($\frac{1}{4}$ per cent.) increases the efficiency of the anesthetics considerably (two to four times) with the exception of quinin-urea, which is rendered less efficient. Epinephrin does not increase the efficiency of these agents when used for surface applications.

Intradermal Use. The wheal method on the human subject gives probably the nearest approach to absolute anesthetic power. For injection anesthesia, cocain, novocain, tropacocain and alypin are about equally efficient; beta-eucain is about one-half and quinin-urea is one-fourth as active; apothetin, antipyrin and potassium chloride are about one-eighth as active. The addition of sodium bicarbonate to cocain or novocain does not increase their activity, when they are injected, as it does when they are used for surface or intraneural anesthesia. The addition of epinephrin prolongs the action very greatly, except with tropacocain. The epinephrin does not, however, change the minimal efficient concentration.

For *intraneural* application, the comparative activities of these agents were measured in terms of the paralysis of sensory nerve fibers, the sciatic being employed. Cocain, novocain, tropacocain, hydrochlorides, are about equally efficient. The efficiency of the potassium salts, alypin, quinin-urea, and especially antipyrin, is smaller. Alkalinization increases the efficiency of organic anesthetics from two to eight times. Epinephrin does not increase the efficiency. Mixtures of cocain with novocain hydrochlorides or with quinin-urea hydrochloride gives simple summation without potentiation. The clinical value of this experimental work is so obvious that it is hoped that surgeons will be able to corroborate it clinically.

SPINAL ANESTHESIA, though it has been in use for the last ten to twelve years and has gradually become one of the recognized agents for producing anesthesia, that it "is still not devoid of danger," to quote Blake, should be an incentive to more careful work in this field. It is

⁴⁴ Journal of Pharmacology and Experimental Medicine, 1918, No. 2.

a question whether some of these dangers are not preventable, and a case of acute osteomyelitis of the vertebræ which followed the use of spinal anesthesia for a hernia operation would seem to be of this class; this soldier, when he came into the care of the reviewer, which was after a period of over three months invalidism. A large sequestrum was removed from the spine.

Rood⁴⁵ feels that, from the large number of cases that have been collected up to this time, it should be possible to formulate a standard technic and the indications for the type of cases in which this form of anesthesia is the most valuable. It is his belief that most of the disastrous results have followed its use in conditions in which it is contra-indicated. As to the *choice* of the anesthetic, he has always employed stovaine, except in 250 cases in which novocain was employed. He found that novocain produced perfect anesthesia but not a muscular relaxation equal to stovaine.

By adding to the 5 per cent. solution of stovaine 5 per cent. of dextrose, he obtained a solution which was heavier than the cerebrospinal fluid. He was able to regulate, to some extent, the level of the resulting anesthesia by the position of the patient at the time of the injection. There is no doubt that although stovaine-dextrose solution is diffusible, its movements are influenced by gravity but for a few minutes after injection. But when a solution of saline is employed, the stovaine diffuses about 10 inches upward from the point of injection irrespective of the position of the patient. Again, the anesthesia produced by the saline solution of stovaine was more transient than in those cases in which the denser solution was used, and it was generally found necessary to employ double the dose of stovaine to produce equally long anesthesia. The mobility of the dextrose solution, however, lasts but for a few moments after injection, and he has never found it possible after five minutes to increase the height of the anesthesia by change of position. Therefore the patient's head and cervical region need only be raised for the first five minutes following the injection, after which they may lie down flat. The obviation of the necessity of keeping the head elevated during the operation—as is usual—is a distinct advantage.

His contra-indications are interesting:

1. Spinal anesthesia is dangerous for patients suffering with shock.
2. It should never be used in aortic disease or in any other cardiac disease in which the patients are subject to syncope.

Abdominal Surgery under Local Anesthesia. Farr⁴⁶ considers that local anesthesia has the following advantages in major surgery over general anesthesia, and makes the plea that it should no longer be confined to minor surgery and to those cases unable to take a general anesthetic.

1. The lessening of turgescence of the vessels when compared to general anesthesia tends to decrease hemorrhage.

⁴⁵ Lancet, January 4, 1919.

⁴⁶ Journal of the American Medical Association, August 9, 1919, No. 6, lxxiii, 391.

2. The dangers from sepsis vary little but favors local anesthesia for the reason that operations may be done more deliberately. This, however, is to be questioned, and in the hands of the average surgeon infection probably is more frequent in the infiltrated tissues than when the incision is made under a general anesthetic.

3. He also speaks of the possibility of localized abdominal infections spreading as a result of the struggles of the patient going under or recovering from a general anesthetic. If the anesthetist devotes the extra time required for local anesthesia to a slower and more careful general anesthesia, struggling should be a negligible factor. That it necessarily minimizes trauma of the tissues and that this is an essential of all surgical technic no one will question at the present time.

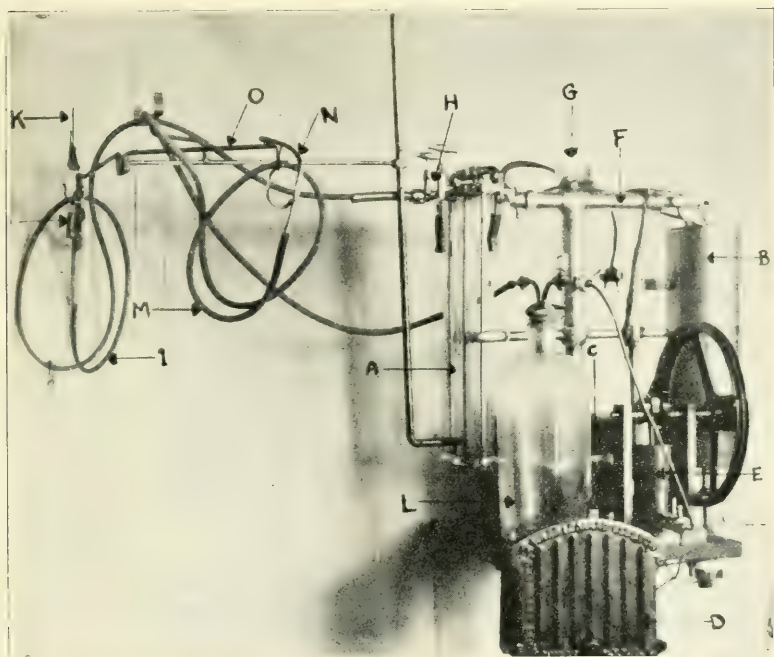


FIG. 61.—Pneumatic injector: A, glass cylinders for procain; B, pressure tank for compressed air; C, motor; D, rheostat; E, compression pump; F, cotton filter; G, air gauge; H, valves; I, flexible metal tubing; J, cutoff; K, needle; L, suction bottle; M, rubber tubing for suction; N, suction tip; O, towel rack. (Farr.)

4. The necessarily increased time required for the operation he feels is fully justified by the advantages to the patient.

5. Assuming that hemorrhage and trauma are reduced by local anesthesia, theoretically there should be less shock, and he feels that, from his clinical experience, this is undoubtedly true.

The percentage of abdominal operations that may be satisfactorily performed under local anesthesia will depend largely upon the experience and skill of the operator. The realization of the fact that operations begun under local anesthesia may be finished under general anesthesia

if it becomes necessary, has greatly increased the scope of this method. Farr begins all abdominal operations under procain anesthesia regardless of the age of the patient.

In all cases except hernia, direct infiltration of the abdominal wall is employed, all of the layers being infiltrated before the incision is made. The general application of this method has been made possible by the use of a pneumatic injector, controlled by a cutoff which gives a constant flow of the solution with a steady pressure.

*Conclusions adopted at the Fifth Inter-Allied Surgical Conference,*⁴⁷ November, 1918: Anesthesia in war surgery.

(1) General anesthesia should be widely employed in war surgery. It is the method of choice.

(2) The agents employed, in the order of preference are: (a) Nitrous oxide and oxygen; (b) ether, more especially warm ether; (c) ethyl chloride; (d) chloroform. Each of these agents should be administered in the smallest possible doses. The use of chloroform is discouraged.

(3) For the severely wounded and shocked, the anesthetizing methods recommended are: Nitrous oxide and oxygen; ethyl chloride; local anesthesia. In the English and American armies, warm ether is used.

(4) Anesthesia by inhalation is dangerous for the wounded who have been exposed to the action of toxic gases; spinal anesthesia is then indicated.

(5) In periods of great surgical activity the anesthesia may be begun by ethyl chloride, and prolonged, if necessary, by ether.

(6) Local and regional anesthesia is only indicated for limited operations, and in a period of reduced surgical activity.

(7) Local anesthesia finds its principal indication in cranial injuries; local and regional anesthesia in injuries of the face.

(8) Intratracheal anesthesia is indicated for wounds of the respiratory passages and upper digestive tract.

(9) For wounds of the chest, general anesthesia is the method of choice. In particularly complicated cases it may be preceded by local or regional anesthesia. In the English and American armies nitrous oxide oxygen is used.

(10) In every anesthesia the greatest care must be given to arterial pressure and to the normal coloration of the face.

TETANUS.

Major General Sir David Bruce,⁴⁸ of the British Army Corps, who has been in charge of the British Tetanus Commission during the war and who speaks with the authority provided by an experience no one has ever had in the past, states in his last report that: (1) The first and most important measure in the prevention of tetanus is the thorough surgical treatment of the wound at the primary operation. (2) There cannot be a shadow of doubt as to the effect of the prophylactic injection of anti-tetanic serum. The reviewer's⁴⁹ experience with the French

⁴⁷ Arch. de méd. et pharm. mil., Paris, 1918, lxx, 705.

⁴⁸ War Medicine, December, 1918.

⁴⁹ Journal of the American Medical Association, September 14, 1918, No. 2, vol. lxxi.

wounded before and after the prophylactic use of anti-tetanic serum is entirely in accord with this statement. (3) The original recommendation of the Committee was that for prophylaxis four injections be given, 500 units at each dose, at intervals of seven days. Though later a primary injection of 1500 units was generally employed, the Commission remains of the opinion that the original dose recommended is correct. In the Italian Army, Tizzoni⁵⁰ found that the increased dose of 1500 units produced better results than the smaller doses of 500 units used in the other armies.

The necessity for the repeated injection of the serum was demonstrated experimentally, and it was found that after ten days the immunity conferred by an injection was, to a great extent, lost.

The literature of war surgery contains a number of reports of tetanus developing even after the prophylactic use of the serum, but in the large majority of them the symptoms were mild and the mortality much lower than in the unprotected. A number of cases are recorded in which tonic spasm has been confined to the tissues immediately surrounding the wound or to that extremity, and the term *local tetanus* has been applied to this condition. Further, a large proportion of these cases of delayed tetanus have been found to be caused by foreign bodies which have been allowed to remain in the tissues and which, upon their removal, contained the tetanus organism. Speed and Kellogg.⁵¹ The tetanus spores have also been found in the sequestra of bone.

The danger of tetanus developing after operative procedures, from quiescent organisms remaining in the tissues for a year or more, is so definite that an order was issued by the Surgeon-General of the American Army that a prophylactic dose of anti-tetanic serum be given to all wounded men at the time of each operation, provided the previous interval was longer than seven days. Tulloch,⁵² working in the Lister Institute, London, for the British Tetanus Commission, tried to increase the protection provided by serum against tetanus by studying the action of the other organisms usually found in the wounds developing tetanus symptoms. As tissue necrosis, and especially that of muscular tissues, will greatly enhance the development of tetanus bacilli in wounds, experiments were conducted with the bacillus *Welchii* and *Vibrio Septique*. As both of these organisms develop diffusible toxins, an attempt was made to demonstrate the symbiotic relationship that was suggested. "The evidence is unequivocal that the antitoxin of bacillus *Welchii*, in addition to neutralizing its toxin, completely protects (in guinea pigs) against the development of tetanus spores in tissues inoculated with them. With the *Vibrio Septique* the results were not so constant. Tulloch concludes 'that the antitoxin of *Bacillus tetanii*, bacillus, *Welchii* and *Vibrio Septique* should be included in all serum employed for the prophylaxis of tetanus.'" Such a preparation of serum was prepared and used in the British Army, but insufficient time elapsed

⁵⁰ Journal of the American Medical Association, September 14, 1918, No. 2, vol. lxxi.

⁵¹ Medicine and Surgery, May, 1918, No. 5, vol. ii.

⁵² British Medical Journal, June 1, 1918, p. 614.

before the cessation of fighting to permit of any definite clinical statistics being obtained.

The use of antitoxin as a curative agent stands upon an entirely different basis than as a prophylactic agent. Bruce⁵³ says: "There does not seem to be any statistical evidence that serum given therapeutically has any marked effect on the rate of mortality. It seems to be admitted that tetanus toxin which has been taken up and fixed by nerves or nerve-cells, is inaccessible to antitoxin. If a lethal dose has been taken up by the nerves and is travelling toward the nerve centers before the serum treatment is begun, no amount of antitoxin given then will save the patient. The giving of antitoxin may, however, neutralize some of the free toxin in the blood and lymph, and prevent its ultimately entering the nervous system and causing death when the toxin already admitted through the motor nerves is not sufficient to do so.

In acute general tetanus the best method of treatment we have at the present time consists in the earliest possible administration of large doses of antitetanic serum by the intrathecal route: Sixteen thousand units on the first and second day intrathecally, and 8000 units intramuscularly.

Bruce states that the Tetanus Commission has been unable to find any clinical evidence that the use of *magnesium sulphate* or *carbolic acid* are of any therapeutic value in the treatment of tetanus and their use has apparently been discontinued in England.⁵⁴

Gessner,⁵⁵ in a study of 427 cases during the period from 1906 to 1918, has made a very interesting analysis of tetanus in civil life. He found, in going back to the earliest possible records of the hospital, the gross undifferentiated mortality during 1918 was the same as it was seventy years ago. The results of his study entirely agree with the military surgeons' valuation of the prophylactic use of antitetanic serum. He makes the suggestion that this value is so definite that a campaign of education should be initiated among the less informed classes of our population in order that they will appreciate that it is the only effective protective measure against tetanus, and must be used at the earliest possible moment after the receipt of the injury, because its protective value rapidly decreases with the increase in the time interval between the receipt of the injury and the injection. As a therapeutic measure, his analysis would also agree with the statement of Bruce that it is the only one that we have at the present time. It would appear, from his statistics, that he has bettered his results by increasing the size of the dose.

WOUND TREATMENT.

At the close of the war one feels that time and experience have removed to a large extent the element of controversy which confused the treatment of war wounds during the first years, and it is now appar-

⁵³ War Medicine, December, 1919.

⁵⁴ British Medical Journal, London, 1918, ii, 415.

⁵⁵ Journal of the American Medical Association, September 14, 1918, No. 2, vol. lxxi.

ently possible to standardize wound treatment under two broad general heads: (1) treatment by mechanical surgical methods; (2) treatment by progressive chemical sterilization.

Even to those who have only had the opportunity of following the literature of military surgery, this confusion has been too evident. It is from the experience of the French and English surgeons who have served during the entire war and the few Americans who volunteered in the early months and remained until after the armistice (as the group associated with the American Ambulance at Neuilly sur Seine) that the story of the development of our present knowledge can best be obtained.⁵⁶

LeMaitre⁵⁷ refers to this experience as his surgical Odyssey, and divides it as follows:

1. Period of surgical delay—October, November, 1914.
2. Period of incision—November to December, 1914.
3. Period of excision of the wound—December, 1914 to January, 1915.
4. Period of excision of the wound and use of antiseptics.
5. Period of excision of the wound and primary suture without the use of antiseptics—July, 1915.

DePage⁵⁸ says that "Contrary to what had seemed established by previous wars, in this war the majority of cases of war-wounds are infected or at least contaminated. In consequence of this, *débridement* became to all surgeons a formal indication of the first rank. In general, all wounds inflicted by war missiles were freely opened up immediately, upon the arrival of the wounded at a hospital sufficiently organized and equipped. (Second period of LeMaitre.) At the same time the contused and lacerated tissues—which constituted a medium favorable for microbic growth—were cut away with the greatest care, so that there was a veritable 'epluchagé' of the wound before proceeding to its dressing." (Third period of LeMaitre.) Since January, 1915, "we have followed at l'Ambulance de l'Océan *débridement* and *epluchagé*, with primary suture, when the cases appeared to us favorable, or we have resorted to secondary suture, as soon after the dressing as the surface of the wound appeared to be clinically aseptic, though we did not possess at that time the scientific method of secondary suture of wounds later developed by Carrel." The chemical progressive sterilization, as developed by Carrel, Dakin and Dehelly, began in 1915 and was first published in August, 1915. This has been referred to in detail in previous reviews of PROGRESSIVE MEDICINE.

Blake,⁵⁹ who like DePage, was actively at work during this evolution period of wound treatment, reviews in the following way the phases through which the treatment of wounds passed. "Military surgeons had no conception of the fact that the full-jacketed bullet could so often cause bursting and shattering effects, and assuming that there would be few operations, totally inadequate provisions were made for the

⁵⁶ Lee: Transactions of the Philadelphia College of Physicians, 1916. Lee-Furness: The Military Surgeon, 1918.

⁵⁷ Medical Bulletin, Paris, March, 1918.

⁵⁸ Transactions of the American Surgical Association, June 16, 1919.

⁵⁹ Annals of Surgery, No. 5, vol. lxi.

avalanche of wounded with lesions of indescribable magnitude and laceration that resulted, and the overwhelmed surgeons had recourse to antiseptics and the antiseptic era was revived. Antiseptics became dominant and therefore I⁶⁰ feel justified in saying that the early surgery of the war was characterized by retrogression rather than progression. Antiseptics instead of being considered as a basis of treatment should only be employed as aids and supplements.⁶¹ The treatment of war wounds may be said to have passed through three stages during the war. The first stage was that of débridement; the wound was laid open, the foreign materials removed, and the tissues left to eliminate by natural processes those portions which could not live. In order to prevent and combat the fulminating infections resulting from the favorable conditions for bacterial growth, various antiseptics were used, some of which acted directly against the bacteria while others, by a sort of embalming process, rendered the destroyed tissues unfit for bacterial food. The evolution of the wound was characterized by prolonged elimination and suppuration.

The second stage of treatment was that in which substances, such as the hypochlorites, were used to dissolve the destroyed tissues and thereby hastened their elimination. Dakin's solution intermittently applied by Carrel's method was most commonly used in France. This treatment finds its chief indication for those wounds to which complete operative treatment cannot be applied, *viz.*, primary suture.

The third stage might well be called the stage of rational treatment for it is based upon the principle that well-nourished tissues can, not only withstand, but can also eliminate, infection. Although this principle was well recognized before 1914, and was practiced by Larry in Napoleon's wars, it is particularly due to the excellent results obtained and reported by the French surgeons, and especially by LeMaitre, that this treatment became generalized. This rational treatment has not only been extremely successful but it has saved an enormous amount of time as well as expensive dressing materials. Although the principle of primary suture may not be new, yet rules were formulated for its application which included organization of personnel, hospitalization, etc., which will be of inestimable value in civil surgery."

This evolution of the treatment of wounds is inseparably connected with studies made of the bacteriology, physiology and chemistry of the involved tissues. And the slow progress toward our present knowledge can only be explained by our ignorance at the beginning of the war of the etiological factors of infection in surgical wounds. In addition to the invaluable knowledge obtained, surgeons have had forced upon them "beyond further debate the necessity for the closest coöperation between the laboratory forces, chemical, physiological, pathological and mechanical, of our civil hospitals." The need for this and its possibilities are detailed by Hartwell and Butler⁶² in "The application of the teach-

⁶⁰ Lee and Furness: Military Surgeon, September, 1918, p. 1.

⁶¹ Dakin, Lee and others: Journal of the American Medical Association, July 7, 1917, lxi, 27-30.

⁶² Surgery, Gynecology and Obstetrics, 1918, pp. 377 and 387.

ing of war surgery to civil hospital conditions." "The military situation made it possible for the surgeon to call to his aid physicists, chemists, pathologists and bacteriologists. He did not have to be dependent upon the former casual contact with the trained minds of these men but had the privilege of bedside conferences and the patient was made the center of every activity. No one can conceive that the advance made in the last three years could have been possible without this full time coöperation between these men, and future progress will certainly depend upon similar opportunities for teamwork."

Dunham⁶³ states: "The bacteriologists have found no new organisms of infection, but they have obtained a more accurate knowledge of the activities of bacteria in the human tissues. It has at last been realized that in order to study the action of bacteria in infected wounds of human tissues, the media must be human tissue and any artificial media employed must be chemically and physiologically as near like human tissues as is possible to make them. To draw deductions from the reactions of bacteria when in water, or the various artificial media that have been employed in the past for experimental work, and to apply them to the bacterial activity in human tissues, is futile."

A STUDY OF THE DEVELOPMENT OF BACTERIA in a wound has shown that pollution is not immediate. Vaucher⁶⁴ writes that "Between the moment of the contaminating injury and the beginning of infection there is always a period the length of which depends on the depth and importance of the muscular injuries and on the amount of blood discharged into the contaminated wound. This length of time seldom exceeds six to eight hours, but there are naturally great variations according to the type of the wound. The reality of the period can be proved first by bacteriological investigation of the smears from the wound, second, by histological investigation of the surrounding muscle.

Smears of Fresh Wounds. In the very beginning the simple smear of a fresh wound shows pure blood, with some muscular tissue and a very few, or no, organisms. After six to eight hours the nature of the exudate changes. Instead of pure blood, there is an important polymorphonuclear reaction. The organisms are numerous. Thick, long Gram-positive bacilli, mostly without spores, are present, and at the same time numerous cocci may develop, but always less abundantly in the beginning than bacilli.

Histological Examination. These investigations have shown that around the devitalized zone of muscle there is a more or less important zone infiltrated with blood. Only after six to eight hours do we notice a reaction of the tissues surrounding the wound; this reaction is characterized in the beginning by dilatation of the vessels and by polymorphonuclear infiltration in the vessel and between the muscular fibers."

The surgical indication then, before the expiration of the six to eight hours and before the infection has had time to spread, is to mechanically excise or remove the wound, its contents—missile, clothing, blood

⁶³ Surgery, Gynecology and Obstetrics, February, 1918, pp. 152-159.

⁶⁴ Medical Bulletin, Paris, March, 1918, Supplement, i, 277.

clots, etc.—and the surrounding dead muscle and extravasated blood which are excellent culture material for bacteria. Further, if this excision is completely made and the potentialities of infection eliminated, the logical surgical procedure is immediate suture and closure of the wound. This six- to eight-hour interval before infection begins to penetrate into the tissue has become known as the *Period of Contamination*. The opening of the wound and removal of the foreign bodies is known as *Débridement*, the excision of the dead tissue as *Epluchagé*. When these processes have been completed, *or the wound Revised*, if the wound is then closed by sutures the term *Primary Closure* is applied.

Tissier⁶⁵ points out that each war wound contains special bacterial flora upon which the future developments in the wound depend. Again, the rate of growth of the bacteria varies not only in different individuals but also in different wounds of the same individual. They increase for a time, then remain stationary and finally disappear, all depending upon the degree of vital resistance of the individual.

The purulent infections usually found in war wounds results from the presence of putrefactive anaërobic bacteria. For the development of these putrefactive organisms it is necessary to have:

- (1) Dead or devitalized tissues.
- (2) The presence of one or more varieties of aërobic bacteria.

The gangrene produced by anaërobic depends directly upon the type of aërobe with which it is associated. With the slightly virulent saprophytes, there is only a local formation of pus; with the *Staphylococcus pyogenes*, it extends slowly; while with the true streptococcus it reaches its maximum and frequently becomes fulminating.

In the purulent wounds in which there are no anaërobic, the aërobic give distinctive types of wounds; practically no reaction is produced by the ordinary saprophytes; the staphylococcus a local reaction; and the streptococcus a general reaction often followed by long-standing supuration, metastatic abscess, chronic bone lesions and slow cachexia.

Thus, only from the character of the bacterial content of the wound can a prognosis of its future be given.

The possibilities of the primary suture of wounds was suggested as a result of bacteriological studies of infected wounds. DePage practised it as early as January, 1915, and LeMaitre in July, 1915. LeMaitre⁶⁶ says: "The method is in contradiction to prevailing beliefs held before the war. It was not conceived then that we could operate upon a wound already strongly contaminated with developing microbes, and close it as though it were aseptic. But it is a combination of surgical acts which are logical." The results obtained by LeMaitre speak for themselves: 12,009 cases admitted to his ambulance; 28.02 days the average stay in the ambulance.

He explained these rapid recoveries by the fact that 80 per cent. of the wounds underwent immediate primary suture; 6 per cent. of the wounds underwent delayed primary suture; 9 per cent. of the wounds

⁶⁵ Bull. de la méd., October, 1918.

⁶⁶ The Medical Bulletin, March, 1918, vol. i, Supplement.

underwent secondary suture. No antiseptics were used, dry aseptic dressings only being employed. For the wounds primarily sutured the average number of dressings were three. For the wounds covered merely with dry gauze dressings and afterward sutured secondarily, the average number of dressings were seven, including the two dressings following the secondary suture.

In addition to the reports of DePage and LeMaitre, similar experiences have been reported by Pierre Duval,⁶⁷ Cuthbert Wallace,⁶⁸ Lewis,⁶⁹ Pool⁷⁰ and Gask.⁷¹ Though this reestablishment of the aseptic principle of wound treatment is one of the great surgical vindications of the war, the experience of time demonstrated that the procedure had definite limitations, and Dehelley still maintains that it exposes the patient to grave dangers. The bacteriologists again made a valuable contribution when they were able to show that the large majority of failures in the primary suture of the wounds were due to the presence of the streptococcus. Tissier⁷² makes the statement "That every primary suture of a wound, based on correct anatomical and clinical principles, where no mistake has been made in the operation, ought to unite, and that, if union fails, this failure is due to the presence of the streptococcus." It therefore became a routine procedure to make a bacteriological examination of every wound before attempting primary closure, and, if streptococci were found to be present, the wound was left open until they had disappeared, when delayed primary or secondary suture was practiced.

The procedure of primary suture of wounds reached its zenith in the winter of 1917-1918, which was a period of comparative calm in military activity. Though LeMaitre had definitely stated, "The retention of the patient in the formation where he has been operated upon and under the unremitting care of the surgeon who has taken the responsibility of the primary suture, is imperative for a minimum period of fifteen days," many surgeons persisted, however, in its practice after the German drive began in March, 1918. When these wounded arrived at the American Ambulance at Neuilly, Colonel Hutchinson was amazed to find the same overwhelming infections as he had previously seen in the wounded coming from the battles of the Champagne and Somme, before the period of, or opportunity for, thorough surgery. It demonstrated conclusively that primary suture must never be attempted unless rest and fixation of the tissues can be assured for a period of at least fifteen days after the operation.

If it has been possible to obtain these remarkable results in the massive wounds of war, better results will be demanded of surgeons in the future in the traumatic wounds of civil life. If it has been possible under the trying conditions of military surgery to develop a technic and organize the necessary personnel and supply the equipment to produce such results there can be no excuse for civilian surgeons, or hospitals, not to

⁶⁷ Medical Bulletin, Paris, March, 1918, i, 19, Supplement.

⁶⁸ Ibid., March, 1913, No. 5, i, 362.

⁶⁹ Journal of the American Medical Association, August 9, 1919, No. 6, lxxiii, 377.

⁷⁰ Ibid., p. 323.

⁷¹ Medical Bulletin, Paris, March, 1918, No. 5, i, 353.

⁷² Annales de l'Institut Pasteur, December, 1916.

do the same under peace conditions. It is to be hoped that the surgeons will not wait to have these standards forced upon them by their patients, many of whom will be returned soldiers.

Primary Suture of Wounds. Gask⁷³ gives the indications for primary suture. "All wounds, other than very insignificant ones, which can be cleansed completely and mechanically within twelve hours after the receipt of the injury and which can be retained in bed for a period of seven days." (Later experience has shown that fifteen days is the safe limit.)

Contra-indication for Primary Suture. 1. Small superficial insignificant wounds requiring no treatment.

2. Small, clean perforating bullet wounds.

3. When patients cannot be retained for fifteen days after operation.

4. Badly shocked patients for whom the long operation necessary for primary suture would constitute a danger to life.

5. Multiple wounds of great severity for the same reason.

6. Wounds which the surgeon cannot hope to cleanse mechanically, *e. g.*, (a) Wounds exposing or injuring large vessels or nerves; (b) large shattering wounds of bones.

7. Wounds already showing active signs of inflammation, *i. e.*, wounds in which organisms have already penetrated living tissue. In this stage much harm may be done by too free surgery, by exposing fresh planes of tissue to infection.

Technic. 1. Preliminary radiographic localizing of foreign bodies and determining the degree of bone involvement.

2. Anesthesia.

3. Usual skin preparation as for civilian surgery.

4. Excision of wound. This under rigid asepsis employing an instrumental technic. Removal of every particle of dead or damaged tissue and wound contents, missiles, débris, clothing and detached splinters of bone. The incision should provide a good exposure of the wound and whenever possible be in the long axis of the extremity. The skin edges are trimmed with a knife after the completion of the incision, and this knife is then discarded and not used within the wound. Where there are wounds of entrance and exit both requiring excision, the track may be slit up along its entire length, or, when in the extremities, it may be in the form of two cones the apices meeting in the middle of the track.

Closure of the Wound: The main principles are:

1. No cavities should be left capable of filling up with blood or serum.

2. Surfaces should be approximated with as little tension as possible and skin sliding or flap sliding be resorted to when necessary.

3. Buried sutures are to be avoided.

4. Suture materials should be non-absorbable.

5. Drainage tubes are not necessary and probably are even harmful. Good drainage may be provided by strands of silkworm gut.

An excellent detailed description of the technic of primary suture is

⁷³ Medical Bulletin of the American Red Cross, March, 1918, No. 5, vol. i, Supplement.

given by LeMaitre in the *Medical Bulletin American Red Cross*, March, 1918, vol. 1, Supplement, p. 307.

"*Delayed Primary Suture* without further excision or freshening of any kind, consists in the repair of anatomical layers, when the gap in the fascia is not too great.

The indications for delayed primary suture are:

1. Inability to keep the patient under the surgeon's personal care for a minimum period of fifteen days.

2. Bacteriological demonstration of the presence of streptococci.

It should take place on the third to fifth day. It has been shown by experience that a wound having no more than one microbe to five fields according to Carrel's numeric method can be safely sutured. When delayed primary suture is planned, the excised wound is merely covered with dry sterile gauze. Duval and many others have found this adequate to preserve the aseptic condition of the wound for several days.

Duval⁷⁴ emphasizes that certain wounds, such as those of the buttocks and to a less degree those of the anterior surface of the thigh and the calf of the leg, should be sutured primarily only in rare instances. When delayed primary suture is not possible and the wound has to be left open for longer than five days, every effort is put forth to perform secondary suture at the earliest possible moment.

SECONDARY SUTURE OF WOUNDS. That it has been found possible to treat mechanically more than two-thirds of the massive wounds of war by primary suture, and thus eliminate the necessity for progressive chemical sterilization and secondary suture is an indication of the relative need of the mechanical and chemical methods in the less severe traumatic wounds of civil life. Though Dehelly is still unconvinced that it is ever justifiable to employ primary suture, and that all traumatic wounds should receive progressive chemical sterilization before closure is attempted, LeMaitre⁷⁵ states just as positively "that when primary suture and delayed primary suture are both impossible, we trust to the vitality of the patient for the disinfection of the wound without striving to destroy the microorganisms, leaving this to the phagocytosis, but taking care not to interfere with the auto-immunization of the patient. We are convinced that, treated in this way, patients are ready for secondary suture as early as if they had been treated by the Carrel method."

In the group of cases which would remain unclosed because primary or delayed primary suture could not be practised, are the following:

1. Massive wounds in which it was mechanically impossible to remove the dead and devitalized tissue.

2. Wounds which had to be left open because it was mechanically impossible to cover them with skin. Such wounds inevitably become infected.

3. Wounds that were in the state of active inflammation when first seen by the surgeon.

4. Wounds in which the streptococci persist.

5. Wounds which developed infection after primary suture.

⁷⁴ Medical Bulletin, Paris, March, 1918, Supplement.

⁷⁵ Ibid., vol. i, Supplement.

In all these wounds more or less dead tissue is present, in some instances the result of the primary trauma; in others, the effect of bacterial action. Its presence insures bacterial growth and its prompt removal is of vital necessity before the closure of the wound can be attempted. To depend upon the slow process of autolysis for the removal of the dead tissue when clinical experience has shown that it can be done rapidly and safely with Dakin's hypochlorite solution does not seem justifiable at the present time.

The treatment of wounds which contain dead tissue impossible to remove by débridement should start with the application of Dakin's hypochlorite solution. The necessity or advisability of continuing this proteolytic solution, as a germicide, after the need for its solvent action has disappeared, is open to question. That LeMaitre's cases without the use of antiseptics were ready for secondary suture as early as those treated with the Carrel method was probably because of the thorough mechanical removal of the devitalized tissues that had been practiced by this master. That the necessary germicidal action, which is often necessary even after the removal of the dead tissue, can be provided in a better way by a more stable form of chlorine than is presented by the hypochlorites, has been suggested by Dakin and Dunham⁷⁶ in their work with chloramine-T and dichloramine-T.

Duval⁷⁷ states that it is now generally accepted that, for "secondary suture, Carrel's count method is insufficient. The examination by culture is absolutely necessary for all wounds. For streptococcic wounds this principle is of the first importance. At present, a wound infected by streptococci can be sutured only after being entirely freed from these organisms. In order to perform secondary suture, the bacteriological examination must be made in the following manner:

(a) Examination by culture on arrival in order to determine the nature of the organisms.

(b) Numerical count examination by Carrel's method during the disinfection of the wound.

(c) Cultural examination at the moment when the wound appears numerically free from microbes in order to be certain of its aseptic condition.⁷⁸

Operative Technic of Secondary Suture. For the secondary suture of wounds in which the granulation tissue has formed, two methods present themselves:

1. Suture of the skin over the granulations.

2. The excision of the layer of granulation tissue and of the surrounding sclerosed tissue.

In the first method the skin margin is excised and the edges undermined to the extent necessary to permit approximation without tension. The edges are stitched together with silkworm gut.

In the second method, the granulations are excised with a knife to a depth which includes all of the scar tissue. Normal tissues which can be

⁷⁶ Manual of Antiseptics, MacMillan Co., 1917.

⁷⁷ Medical Bulletin, March, 1918, vol. i, Supplement.

⁷⁸ Perkins: Annals of Surgery, September, 1918, No. 3, vol. lxxviii.

sutured layer to layer are then laid bare and united with fine cat-gut. To suture over pathological granulations leaves the scar tissue, and the functional result is never as good as when the scar tissue is removed.

Gas Gangrene and Maggots. Crile, at the meeting of the American College of Surgeons in 1917, reported that war wounds containing maggots progressed more favorably than those free from them. This observation was not taken seriously at that time, but since then it has been confirmed by a number of military surgeons. Hughes and Banks⁷⁹ state, "During the Somme offensive in 1916, many wounds of a very serious nature arrived at the casualty clearing stations infested with maggots, and the salient fact stood out that maggots and gas gangrene did not exist together in the same wound. Again, at the clearing stations some grossly infected gangrenous wounds were put outside the Marquees, partly for their own benefit and partly for the benefit of those lying in the same tent. To a few of these wounds flies gained access and the wounds became fly blown, and, with the appearance of the maggots, the gas infection disappeared. Maggots would stay in the wound only as long as there was dead tissue present for them to live upon and they did not seem to exert any harmful effect on living tissue. We are of the opinion that it is unwise to destroy maggots while there is dead tissue still present, but better to let them continue their existence until they have digested all such tissue."

The Laws of Cicatrization of Cutaneous Wounds. Lumière⁸⁰ has found that the cicatrization of wounds of the skin or of soft parts, not accompanied by bony, vascular, or nerve lesions, and not in communication with deep suppurative areas, follows constant rules in individuals between twenty and thirty years of age and in good health.

1. The rate of cicatrization of wounds kept aseptic is in general the same at the beginning as at the end of their regeneration.

2. The time necessary for the cicatrization of a wound is approximately proportional to its maximum diameter.

3. Traumatizations and contaminations of the wound retard the formation of skin.

4. Frequent non-adherent dressings are preferable to infrequent dressings.

5. The use of antiseptics assures regularity in the progress of the reparative process.

7. Well disinfected wounds not contaminated in the course of their treatment by aseptic methods cicatrize at the average daily rate of 1.20 mm. to 1.30 mm., while with antiseptic treatments the diminution varies from 1 mm. to 1.72 mm. per day.

BURNS.

Paraffin Wax Treatment of Burns. In the 1918 review in *PROGRESSIVE MEDICINE*, attention was directed anew to the paraffin wax or the

⁷⁹ War Surgery, William Wood & Co., 1919.

⁸⁰ Rev. de chir., Paris, 1918, liv, 168; Rev. Surgery, Gynecology and Obstetrics, January, 1919, No. 1, xxviii, 64.

closed method of treatment of burns by Sherman's⁸¹ report, and the greater part of the literature that has been published upon burns for the past twelve months, has been devoted to arguments for and against this method of treatment. Albeit the reports and literature are generally favorable and the writers enthusiastic as to its value, a great many surgeons have not been able to attain the results reported, and there seems to be a growing feeling that there are definite limitations to its use and also some dangers. There has never been in the past any standard treatment of burns because any one of the numerous modes of treatment seemed to give about the same result, namely, an unsatisfactory one, and all leave much to be desired from the point of view of both the patient and the surgeon.

Stewart⁸² has given an excellent designation of an ideal dressing for severe burns, which should be (1) aseptic or (2) mildly antiseptic, (3) that it should provide free drainage, (4) that it will not macerate the tissues nor (5) stick to them and (6) that it must not necessitate frequent changing. Still another essential might be added, namely, (7) that it should minimize the abnormal radiation of body heat from surfaces denuded of the protection of the skin and subcutaneous tissues.

We do not have at the present time any one method for the treatment of burns which fulfils each and all of these specifications. Wet dressings macerate, and dry dressings stick to, the wounded surfaces; ointments are not aseptic and cannot be used when they contain chemicals of sufficient concentration to be antiseptic, and, in addition to infecting the wounds, they form an impervious covering over their surfaces and prevent drainage of the secretions. This is notably the case with Carron oil and all the vegetable oils, and a recent personal experience with burns has demonstrated that sterile mineral oil also prevents the necessary drainage from some burned surfaces.

Ambrine, and the many other forms of paraffin films which are now being used, do meet some of these requirements. They should provide an aseptic dressing. Rothchild⁸³ emphasizes the necessity for the use of *sterilized wax and cotton*, and of strict surgical asepsis in the application of this dressing; and he points out the striking difference in the appearance and trend of the wounds when these surgical precautions are not taken. In almost all of the descriptions of the treatment in this year's reports, there is a failure to mention this essential principle; which may be one of the reasons for some of the unsatisfactory results. Rothchild's careful description of the sterilization of the wax and of the utensils and materials used in the application of the shell is a marked contrast to the average care one sees expended upon the paraffin atomizer or the paraffin in the hospitals in this country, where it is usually treated with the same care as a cabinetmaker devotes to his gluepot. The ambrine and paraffin films are in no sense antiseptic dressings. The wax does not

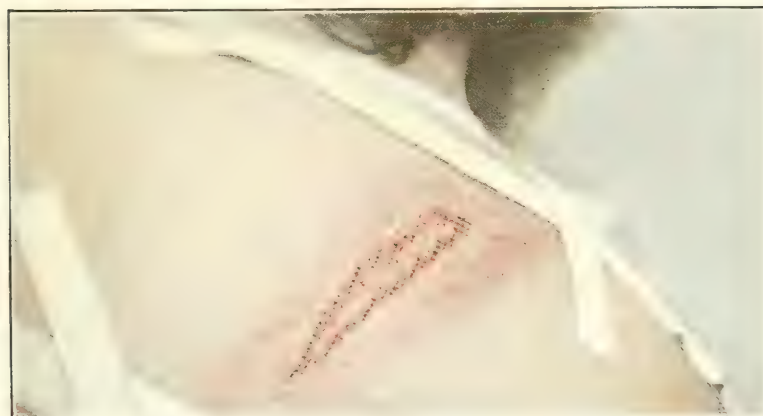
⁸¹ Surgery, Gynecology and Obstetrics, April, 1918, pp. 450-451.

⁸² Manual of Surgery, Blakiston.

⁸³ Traitement des Brûlures par la Methode Chirique, Pansement à l'Ambrine, Octave Doin et Fils, Paris, 1918.



Burn of Six Weeks' Duration before Treatment with
Dichloramine-T.



Paraffined Netting Applied Over the Burn.



After Four Weeks' Treatment with Dichloramine-T.

contain any specific curative chemical ingredient, but acts entirely mechanically. Though at times painful on application, the dressings can usually be painlessly and easily removed. They do not require frequent changing. The wax shell does to a certain extent act as an insulating covering and decreases the radiation of the body heat from the wounded surface. But they are impervious dressings and deliberately designed to prevent drainage. Their object is to provide a complete retention of the wound discharges from one dressing to another; "the dressing serves as a poultice, the retained body heat under the insulating wax shell produces a hyperemia with a resulting increase of lymph, and it was Sanford's original theory that the antitoxins and autolysins in the exudate were to be depended upon to remove all dead tissues and destroy bacterial growth." As a result maceration on the surfaces of the wound usually occurs.

Sherman's statement that "all burns, regardless of character, are thoroughly dried and an airtight coating of paraffin wax is applied to the burned area and including one-half inch of the immediate margin adjoining the burned area," would seem, in view of our experience with war wounds, to be so general and all-inclusive as to be dangerous. With our present knowledge, no surgeon would deliberately close a traumatism containing infection or dead tissue. These same surgical principles certainly are applicable to burns as well as to any other kind of wound. Fauntleroy and Hoagland⁸⁴ state that they are convinced that as burns differ widely as regards degree, character of tissue destruction, bacterial content, progress of healing, etc., "no one procedure as a local measure—wet or dry dressing, wax or ointment, or no one solution—will prove equally valuable for all cases."

The whole question of the treatment of burns is a timely one; the Ambrine, or the wax treatment, represents an effort to "transport it from empiricism to the field of exact science." Rothchild deems it comparable to the change from the pre-war uncertain therapeutics of surgical infections to the accurate methods of Wright and Carrel, and any criticism of it should be constructive and not alone destructive.

Credit for an earlier advocacy of an antiseptic and occlusive dressing of burns should be given to MM. Nageotte-Wilbouchewitch.⁸⁵ Their report of cases in Paris, in 1893, outlined a treatment consisting of a rigorous mechanical cleansing of the wound under general anesthesia and then the application of a covering of adherent varnish.

The same principles of treatment apply to burns as have proved of such practical value in directing the treatment of traumatic wounds in general, the degree and character of the infection and the presence of dead or devitalized tissues. It therefore seems reasonable to suggest that our treatment of burns should closely follow that of traumatic wounds.

Burns may then be classified as: (1) Non-infected; (2) contaminated; (3) infected.

In the non-infected class would be burns of the first degree and those

⁸⁴ *Annals of Surgery*, June, 1919, vol. lxi.

⁸⁵ *Th. de doct. Paris*, G. Steinheil, 1893.

of the second degree when the blisters are unbroken. In this type of burns the surgical principle of primary closure and prevention of secondary infection is clearly indicated. The airtight occlusive dressing provided by the paraffin films may be regarded as a primary closure of such wounds. Both Sanford and Rothchild, in reporting their results, have used Dupuytren's classification of burns, in which the second and third degrees are comparable to the first and second degrees in the classification in common use in America; this, to us, at first glance makes the results they obtained seem unusual.

Burns which can be treated within the first three hours after the injury, and in which it is possible to remove by mechanical means all of the dead or devitalized tissue, could be classified as contaminated. The corium of broken blisters and possibly small areas of superficial localized necrosis is the limit of the dead tissue which it is practical to remove by mechanical measures. It would be justifiable to attempt the primary closure of this class of burns with the paraffin film, but upon the first sign of infection, general and local, the occlusive dressing should be removed and the burn treated as an infected wound. It is difficult to understand how one can justify the primary closure of burns in which infection is present, or of burns in which infection will inevitably develop because of the irremovable mass of devitalized tissue, when we bear in mind our recent experience in the war in the treatment of infected traumatism. Too much emphasis cannot be placed upon this warning; the neglect of it has too often resulted in disaster.

The occlusive film dressings should never be applied to burned surfaces containing streptococci, or in which there is devitalized tissue or the symptoms of absorption from a toxic exudate, just as in the indication for the secondary closure of traumatic wounds. In all third and fourth degree burns, of large area with extensive sloughing and absorption of toxins, the Carrel-Dakin or dichloramine-T methods of disinfection should be carefully carried out, when possible, before applying the ambrine or other occlusive dressings.

The problem presented in the sterilization of infected burns is not, however, quite the same as in the other infected traumatic wounds.

Stewart⁸⁶ has said that the ideal method would be the total excision of the involved tissues and immediate suture. But, if this were mechanically possible, the necessary anesthesia could not be given to patients in such degrees of shock and toxemia as are so frequently encountered in extensive burns. These same conditions, shock, toxemia, and masses of devitalized tissue impossible of mechanical removal, were encountered in traumatic war wounds and then Dakin's solution, with its invaluable property of dissolving dead tissues, provided the necessary means for the purpose; but, in our experience, Dakin's solution of hypochlorite has, in the large majority of cases, proved far too irritating for the burned patients to permit of its use. No other agent has been suggested up to

⁸⁶ Loc. cit.

the present time which has this desirable proteolytic property, and, in the cases in which it has not been possible to use it, we have had to depend upon natural autolysis and mechanical cleansing.

A daily immersion in a normal salt solution, at body temperature, and then exposure of the burned area to the air for the next twenty-four hours has been the most satisfactory local treatment in the early stages. When the trunk is involved, or large areas of the extremities are denuded of skin, undue radiation of body heat is guarded against by covering the patient with a blanket tent and maintaining a constant temperature of 92° to 95° F. under the tent by means of electric lights. The application of a single layer of a paraffined, wide-meshed gauze to the burned surface will provide adequate drainage from the wound and permit of the painless removal of the inspissated exudate at the time of the daily bath in salt solution.⁸⁷

Concurrent with the removal of the devitalized tissues will be a lowering of the bacterial content, but rarely will the necessary sterility be obtained to justify the secondary closure by the paraffin film, or to guarantee the best results from skin-grafting, without the use of antiseptics.

As an antiseptic for burns, we have not felt that Dakin's hypochlorite solution was indicated because of its small germicidal value. It also is so irritating to these hypersensitive surfaces, that in our experience, patients will rarely permit of its use. To many individuals the chloramines also are painful; but with either of these antiseptics the utmost care is necessary to be sure of their purity.

The early reports of the almost impossible skin regeneration following the use of the paraffin films have proved to be somewhat exaggerated and not always trustworthy. That there is a greater degree of skin regeneration than surgeons have been accustomed with the empirical methods of the past, there is no doubt; but the necessity for skin grafting occurs in a large proportion of the burns of the third degree. The best results are obtained upon surfaces approaching nearest to surgical sterility and with the shortest interval of time after the injury.

Dichloramine-T and Petrolatum Dressing for Burns. To prevent the sticking of the dressings to burns which have been treated with dichloramine-T chlorosane solution, Sollmann⁸⁸ suggests an ointment composed of three parts of surgical paraffin to be applied as a protective dressing to the wound. He recognizes the fact that petrolatum causes dichloramine-T to decompose and cannot be used effectively with it and therefore it would seem that such an ointment could be entirely replaced if its only indication was the preventing of the sticking of the dressings to the surface of the wound by interposing a paraffin wide-mesh gauze between the gauze dressing and the wound as suggested by Lee and Furness.⁸⁹

⁸⁷ Lee and Furness: *Therapeutic Gazette*, May 15, 1918.

⁸⁸ *Journal of the American Medical Association*, 1919, lxxii, 992.

⁸⁹ *Annals of Surgery*, January, 1918.

Skin Grafting. Shawan,⁹⁰ in 26 cases of successful grafting, employed the auto- and isografts, testing the donors and recipients for blood groupings according to the classification of Moss, concludes (1) Auto-grafts grew best; (2) isografts obtained from the donors of the same blood group as the recipient or from donors of group IV became permanent takes and grew almost, if not equally, as well as autografts; (3) when the donors and recipients were of different groups, isografts did not remain as permanent growths except when group IV skin was used or when the recipient was a member of group I; (4) group I recipients grew permanent skin from all the donors of the four groups and apparently equally well; (5) group IV skin grew permanently on recipients of all groups, but only group IV grafts and autografts remained as permanent takes on group IV recipients; (6) it appears that skin grafting obeys the principles of blood grouping as used in the transfusion of blood.

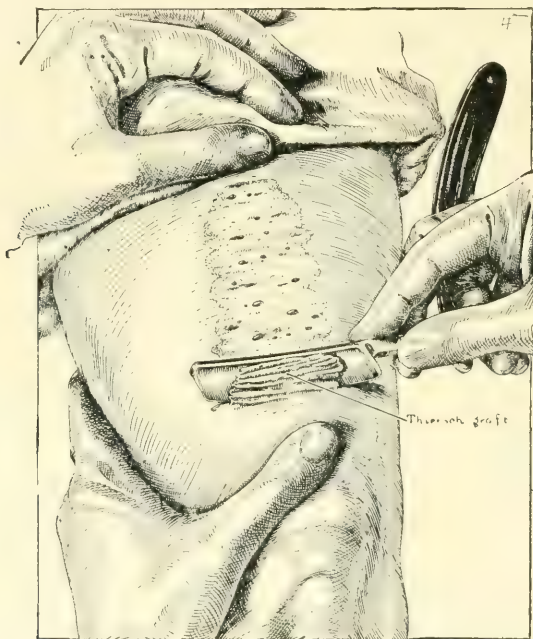


FIG. 62.—Ordinary method of obtaining Thiersch graft.

All authorities agree that the autograft is the most satisfactory, but in the past few have had any confidence in the use of isografts. Mason⁹¹ is satisfied that there is a much larger field of usefulness for the isograft than has been generally believed, for since he has been testing the bloods of the donor and recipient for agglutination, he has obtained much more favorable results. He has never had a skin graft live which was removed from a donor whose red blood corpuscles were agglutinated by the serum of the

⁹⁰ American Journal of the Medical Sciences, 1919.

⁹¹ Journal of the American Medical Association, 1918, lxx, 1581-1584.

patient. In all other cases the results have been very satisfactory, almost, if not entirely, equal to autodermic grafting. In preparing the denuded surface for the graft, he emphasizes the removal of excessive granulation, improving the circulation to the part and, when infected, the use of neutral saline, Dakin's solution or dichloramine-T, until the wound is made sterile, as shown by smears on three consecutive days. A Thiersch graft is then cut after the ordinary method. If the skin is thick, a second layer may be removed from the same area in the same way, or small island grafts may be taken from the center of

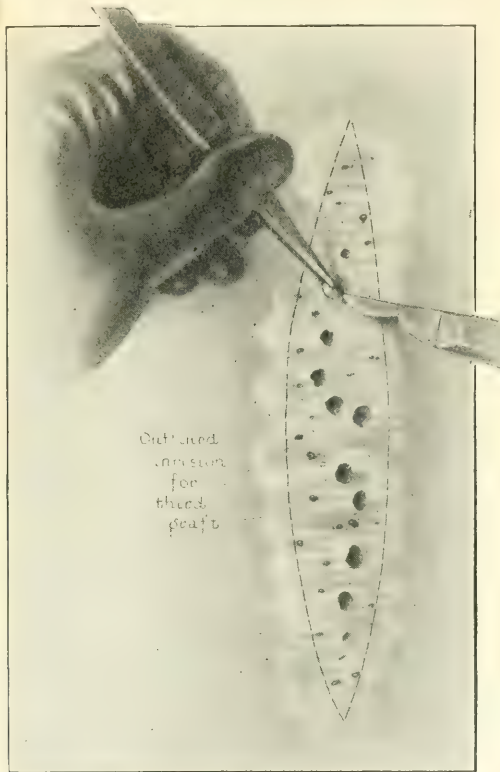


FIG. 63.—Further utilization of area from which Thiersch graft has been removed.

the raw surface including some of the deeper layers of the epidermis and the superficial layers of the dermis (Fig. 62). To reduce the size of the wound made in taking the grafts, an elliptic piece of tissue may be cut from the wound and the remaining edges sutured together with silkworm gut. The tissue thus removed can be utilized for grafting by cutting it into small sectional grafts and applied after the method of Reverdin. When using large Thiersch grafts, he calls attention to the necessity of puncturing them at numerous points to allow the free escape of serum which would otherwise tend to float them from the surface. The dressing is of the utmost importance. When the wound



FIG. 64.—Excision of remaining layers of skin from surface denuded by Thiersch graft.

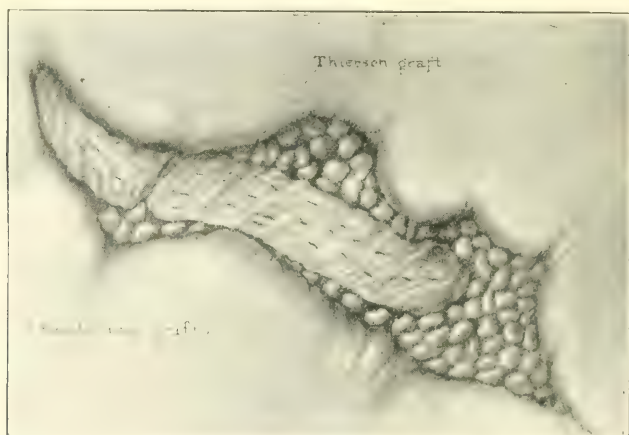


FIG. 65.—Wound covered with Thiersch grafts and small deep grafts taken from denuded area.

is completely covered with Thiersch grafts, the open exposure to the air and protection of the surface by a wire screen is probably the best. Crusts or thick secretions are removed and dichloramine-T 4 per cent. or neutral solution of chlorinated soda applied by an atomizer. When the wound is only partially covered with grafts, the most satisfactory dressing is the covering of the raw surface and graft with open mesh net that has been previously impregnated with paraffin,⁹² and the application of wet saline dressings changed every four hours for three days without disturbing the paraffin net, the latter being held in place by sutures or by applying soft paraffin along the edges to fix it to the surrounding skin. After the third day, the open air is used during the daytime and the wet dressings at night. Frequently, the paraffin net becomes adherent to the grafts when using the wet dressings, and open air treatment, but a liberal amount of liquid petrolatum applied from four to six hours before attempting its removal loosens it.

ANTISEPTICS.

The use and abuse of many agents as antiseptics in war wounds has been productive of an enormous literature. The pre-war method of choice and use of antiseptics was entirely empirical and when the same methods were applied to the massive infections of gunshot wounds, chaos resulted.

It was not until the problem was approached in a scientific way by Wright, Dakin and Carrel, with adequate analysis of the chemical, physiological, biological and pathological factors involved, that any adequate knowledge of the subject was obtained.⁹³ That the human tissues have a very definite vital resistance to bacterial infection has been conclusively demonstrated by our military experience. The standard of surgical sterility which has been established by Carrel as the result of his practical experience with war wounds—one bacterium in four or five microscopic fields after two consecutive counts—represents from sixty to eighty organisms to 1 c.mm. of the exudate, a far cry from bacterial sterility. And it is because of this vital resistance of the tissues that it has been possible to practice primary and delayed primary suture in the war wounds without the use of antiseptics. As a result of this military experience, surgeons in the future will have more faith in, and depend to a greater extent upon, the vital resistance of the patient's tissues than they have dared to do in the past.

But, as this vital resistance is a variable quantity, modified by constitutional disease, fatigue, starvation, hemorrhage, etc., the maximum is rarely attainable. The removal of the factors of infection, the focus, devitalized tissues, the lessening of the time interval between injury and treatment, and the possibility of the complete mechanical closure of the wound and subsequent rest of the injured part, are not always possible, and surgeons will still have to depend upon antiseptics for help in a large proportion of the infected traumatic wounds of civil life.

⁹² Lee and Furness: *Therapeutic Gazette*, May 15, 1918.

⁹³ Dakin and Dunham: *Handbook of Antiseptics*, Macmillan Co.

The new work upon antiseptics may be said to be based upon the following principles:

1. The laws governing chemical disinfection, which have been worked out by Chick,⁹⁴ show that, in all essential particulars, the act of disinfection can be regarded as obeying the laws governing the simple chemical reaction, the disinfectant representing one reagent and the bacteria the other. This conception is of the greatest importance since the cardinal points of disinfection are thereby experimentally established, namely, adequate active mass or concentration of an antiseptic, time of action and perfect contact.

2. That the germicidal activity depends to an extraordinary degree upon the media in which the antiseptics act, and almost invariably reaches the maximum in distilled water or salt solution. This was appreciated very early by the workers at Compiègne, and all conclusions and estimates as to the germicidal agents were shown to be fallacious unless the artificial media employed were chemically similar to that of the human tissues.⁹⁵ In this connection, an interesting report of a method for estimating *in vivo* the germicidal activity of antiseptics is made by Perkins.⁹⁶ Localized areas of osteomyelitis were used, and uniform platinum loopfuls of exudate, taken at two hourly intervals, were suspended in bouillon and poured over agar plates. The colonies developing were counted and from these counts graphic curves were plotted.

The work of Carrel and Dakin, at Compiègne, is now too well-known to need to be reviewed and their experimental and clinical findings, that the chlorine group of antiseptics, when applied by their technic, gave results superior to any other agent, have been fully confirmed by military surgeons of the French, English and American Armies.

That chlorine could be presented to the tissues without the destructive effect which has prohibited its use in the past has been one of the surprising developments of the war. The use of Dakin's dilute Labarraque's solution containing 0.5 of hypochlorite was not followed by untoward results in the infected war wounds as long as they contained dead tissues or exudates, but it too often exhibited the inherent irritating effect of chlorine upon the surrounding skin. Dunham and Dakin,⁹⁷ experimenting on the web of a frog's foot, found that Dakin's solution of hypochlorite affects the human tissues in an inverse proportion to their blood supply. Thus, the superficial horny layers of the frog's web were quickly destroyed, then followed the subcuticular tissues, but, as the chlorine approached the bloodvessels, its action slackened, and finally became arrested and there was a distinct protecting zone about the vessels. Their explanation was that the continuous transudation of the protein in the blood plasma through the vessel wall formed a chemical reaction with the chlorine and the resulting stable chloramine compounds acted as a neutralizing barrier.

The experiments of Gray⁹⁸ and the clinical, classroom demonstra-

⁹⁴ Journal of Hygiene, 1908, p. 92; 1910, p. 238.

⁹⁵ Dunham: Surgery, Gynecology and Obstetrics, February, 1918, p. 152.

⁹⁶ Annals of Surgery, No. 3, lxxviii, 241.

⁹⁷ Handbook of Antiseptics, Macmillan Co.

⁹⁸ Bulletin of the Johns Hopkins Hospital, October, 1918.

tions during the war at the Rockefeller War Demonstration Hospital, showed a similar destructive action of all the tissues of the mesentery, except the bloodvessels was shown when Dakin's hypochlorite solution was injected into the normal peritoneal cavity of a cat or dog.⁹⁹ On the other hand, it has been shown clinically, during the last three years, that the hypochlorite solutions can be used with impunity in a peritoneal cavity in which there is an exudate, as in appendiceal and pelvic abscesses, where the necessary protein is accessible and present in sufficient quantities to form a barrier against the action of active chlorine. Therefore, the danger to the



FIG. 66 (Experiment 212-17).—Intestine and mesentery after an intraperitoneal injection of Dakin's solution.

human tissues from the use of Dakin's hypochlorite solution depends upon the amount of chemically available protein. The dead tissues of wounds and the exudates from the peritoneal, pleural and synovial membranes do this. Hartwell and Butler made a clinical observation, which corroborates the experimental work of Dunham, to the effect that the more blood supply the tissue possesses, the less destructive would be the action of the hypochlorite solutions. Thus, there is practically no action upon muscles, but, upon tendons, when not pro-

⁹⁹ Collective Papers of Mayo Clinic, 1918, vol. x.

tected by active suppuration, a rapid solvent action occurs and in their work its use was discontinued in this tissue.

The peculiar solvent or proteolytic action of Dakin's solution of sodium hypochlorite is not generally realized to have been its greatest asset in the treatment of war wounds. The small masses of devitalized tissue of the traumatic wounds of civil life can practically always be eliminated by mechanical means or by the natural autolytic processes of the tissues, and rarely is the vital resistance embarrassed, at least to such an extent as to endanger life, as was the case in war wounds. The war wounds provided huge masses of dead tissues which were ideal culture material for rapid and virulent bacterial growth, and the vital resistance was usually overwhelmed. The prompt and efficient removal of these tissues by the solvent action of Dakin's hypochlorite, and, in the last years of the war, by thorough mechanical excision, permitted the full action of the vital resistance of the living tissues. The chemical action which occurs when chlorine is presented to the tissues, as in the hypochlorite solutions, are almost infinite. However, Dakin and Dunham¹⁰⁰ feel that the proteolytic action of these solutions is not primarily due to any action of the chlorine but to the various salts which are secondarily formed. Thus when sodium hypochlorite NaOCl gives off its chlorine, a hydrogen element unites with the NaO radical to form NaOH , sodium hydroxide. This caustic soda is one of the many inorganic salts formed, and it acts as the solvent agent and not the chlorine.

The chlorine, as it splits off from the sodium compound, among numerous other reactions, unites with the proteins to form more stable compounds which are known as the chloramines. As all bacteria are composed of protein, the chlorine, when reacting with bacterial protein, exerts a direct germicidal action. These chloramines, though more stable than the hypochlorites, holding their chlorine while in the tissues from three to twenty-two hours instead of from seven to ten minutes as do the hypochlorites, also break down, and the chlorine is again liberated and again unites with other proteins, and if the reaction be with bacterial proteins, again exerts a direct germicidal action, as did the original hypochlorite. This splitting off of the chlorine from the chloramines results each time in the formation of more and more stable chloramine compounds until, finally, a point is reached, after many hours, where the chlorine is so strongly bound to the amines that its germicidal possibilities cease.

The practical bearing of all this upon the use of the chlorine group of antiseptics, sodium hypochlorite, chloramine-T and dichloramine-T, may be stated as follows:

1. The direct germicidal action of all the chlorine antiseptics depends upon the chlorine which they liberate when in the human tissues and upon the combination of the chlorine with bacterial proteins.
2. The solution of sodium hypochlorite can only be used clinically in very weak dilutions because the rapidity with which it liberates chlorine

¹⁰⁰ Handbook of Antiseptics, Macmillan Co.

requires the living tissues to provide ample protein to protect themselves against its destructive action. The safeguard against the destructive action of chlorine is a sufficient mass of chemically available protein.

3. The solutions of sodium hypochlorite, unlike the chloramines, dissolve dead and devitalized tissues by the formation of proteolytic inorganic salts like sodium hydroxide and thus exert an indirect antiseptic effect by removing bacterial culture material. Taylor and Austin¹⁰¹ found, from their experiments, that Dakin's hypochlorite solution had the power of dissolving necrotic tissue, pus and plasma clot in the concentration and reaction used clinically. Chloramine-T and dichloramine-T did not exhibit this action.

4. The chloramines are more stable compounds of chlorine than the hypochlorites, and therefore can be used in greater concentrations or larger germicidal masses. They act practically as reservoirs from which chlorine is automatically given off as the tissues present the necessary reacting substances. The reactions of these organic chlorine compounds do not form the solvent mineral salts as do the hypochlorites when in the tissues.

5. The hypochlorite solutions are indicated where there are large masses of dead and devitalized tissues or profuse tissue exudate which cannot be removed by mechanical means, *i. e.*, massive traumatic wounds, empyema. They should not be used where such protein barriers are not present or applied to tissues poorly supplied with blood.

6. The chloramines are indicated where there is but little, if any, dead tissue, and where the wound exudate is moderate in amount. Their only value is as a germicide. They liberate their chlorine, when in the human tissues, slowly over a period of from three to twenty-four hours and in sufficient quantities to unite automatically with the bacterial and other proteins presented by the wounds.¹⁰²

In the *Military Surgeon*, September, 1918, Lee and Furness report their clinical work upon the use of dichloramine-T in the treatment of surgical infection. They refer to Dunham's conditions governing the degree of success that can be obtained in disinfection by the use of germicidal agents.

1. Actual contact of the germicide with the infecting organisms.

2. The maintenance of such contact for a sufficient length of time. This should be continuous if possible.

3. An adequate mass or concentration of the agent at the points of contact.

Contact is essentially a mechanical problem and the surgeon can place no dependence on the power of penetration of any known germicide.

Time and mass cannot be dismissed in such general terms.

The time during which contact can or should be maintained depends upon:

1. The speed or rate of disinfection of the agent employed.

2. The stability of the agent under the conditions of its use, which, of course, directly affects the period over which one application will act.

¹⁰¹ Journal of Experimental Medicine, 1918, xxvii, 155.

¹⁰² Lee and Furness: Military Surgeon, October, 1918.

The mass is determined by the permissible concentration that can be employed. And this concentration is governed chiefly by the degree of irritation occasioned by the agent, especially upon the skin and mucous membrane, as these are more susceptible than the deeper tissues.

Dichloramine-T possesses to an unusual degree the properties essential to meet these conditions outlined by Dunham: Contact, time, mass. When pure and free from hydrochloric acid (which unfortunately many of the commercial preparations contain), it can be used in larger masses than any of the other chlorine compounds. A 10 per cent. solution of dichloramine-T in wounds presents forty times the germicidal mass offered by 0.5 per cent. solution of hypochlorite. Because of its peculiar stability in oil solutions and unusual speed of disinfection, the required time of contact with the infecting organisms is readily maintained. Under average conditions, its germicidal activity lasts about eighteen hours in contrast to the seven to ten minutes of Dakin's hypochlorite solution. In regard to speed of action, Dakin and Dunham¹⁰³ have shown that a 2 per cent. solution acts with a speed eight times that of Dakin's hypochlorite, eight hundred times that of a 1 to 1000 solution of bichloride of mercury, and at least two thousand eight hundred and eighty times that of 2 per cent. solution of carbolic acid.

Lee and Furness developed a technic for obtaining the necessary contact of the agent with the infecting organisms, and, in some 20,000 cases in civil and industrial surgical practice, came to the following conclusions:

1. That the use of dichloramine-T has definitely improved the results obtained in the primary closure of traumatic wounds of the soft tissues, bones, and joints.

2. That in the treatment of superficial accessible infection the use of dichloramine-T has uniformly given better results than any other germicide they have employed and that the method of its application is simpler and the dressings more economical than with any of the other chlorine agents.

3. That the best results with dichloramine-T can only be obtained when actual chemical contact of the germicide with the infecting organisms is maintained.

4. Our confidence in the germicidal value of dichloramine-T has so developed that when it does not control infection we feel that the chemical contact has not been maintained, the mass of germicide employed has not been sufficient, or adequate surgical treatment has not been given.

5. The striking detoxicating effects of the chlorine group of agents which has become common knowledge through the general use of Dakin's hypochlorite solutions is just as satisfactorily exhibited with dichloramine-T.

The technic which they describe in detail demands the same degree of surgical asepsis as has been taught by Carrel. Infections and infected wounds are treated with the same surgical asepsis one follows in the care of sterile wounds, and this applies not only to the primary operation but to all subsequent dressings. In addition, they insist upon an absolutely rigid instrumental technic.

¹⁰³ *Surgery, Gynecology and Obstetrics*, February, 1918, pp. 152 and 159.

In this group of cases, of course, the foci of infection and the masses of dead tissue, unlike war wounds, were practically all removable by mechanical means, and they lay definite stress upon the necessity for the excision of the focus of infection when mechanically practical, or in any event, its wide exposure to provide the necessary opportunity for a complete chemical contact of the germicide with the bacteria. In the treatment of traumatic wounds, they emphasize the absolute necessity of excising all dead tissue and the removal of foreign bodies and blood clot before attempting the closure of the wound. Thus in this group of cases the proteolytic solvent action of the hypochlorite solution was not required because of the possibility of the surgical removal with the knife.

In the treatment of infections with this oily solution, one of the disadvantages developed was the sticking of the dry dressing to the wound surface. The interposing of a wide mesh paraffin gauze between the wound and the gauze dressing provided a practical way to avoid this difficulty.

In the treatment of carbuncles, they abandoned total excision of the infected area, finding that deep crucial incisions, extending beyond the infected area in all directions, were all that was necessary. Their routine practice was to suture the carbuncles after sterility was obtained.

In the treatment of incised, lacerated and crushed wounds, they followed the principles employed in the primary, delayed primary and secondary closure of war wounds, placing, however, before the closure of the skin, a thin film of the dichloramine solution over the wound surfaces.

Up to the present time the commercial preparations of dichloramine-T vary greatly as to their stability. Pure dichloramine-T is stable and non-irritating to the skin and mucous membranes, and, when irritation follows its use, it is due to decomposition having taken place, with the production of hydrochloric acid. The tests for the decomposition of the preparation are as follows:

Decomposition of dichloramine-T itself is evidenced by a strong smell of chlorine and incomplete solubility in chloroform. Advanced decomposition of solutions of dichloramine in chlorcosane is shown by the deposit of crystals.

The solutions of dichloramine-T in chlorcosane should be neutral. The presence of the slightest trace of acid, which is usually hydrochloric, decomposes dichloramine-T, and when once initiated its progress of decomposition is very rapid. The acidity of dichloramine-T solutions can be tested with a piece of blotting paper saturated with ammonia water held over the surface of the suspected solution. If the slightest trace of acid is present, white opaque fumes of ammonium chloride will be given off from the paper.

Solutions of dichloramine-T in chlorcosane, however, are remarkably stable considering the high reactivity of the antiseptic. And yet, when compared with the agents which surgeons are accustomed to handling, carbolic acid, bichloride of mercury, etc., many more precautions are necessary in using it. Lee and Furness make the following suggestions:

1. Care should be taken to test the solution and determine whether it is neutral and free from acid.

2. It should be supplied to the wards of hospitals in small containers only, as much as will be used in one or two days. For the average hospital ward, this is rarely more than one ounce.

3. All stock bottles should be of a very dark amber color and glass stoppers (blue bottles apparently hasten its decomposition more rapidly than clear glass). Light, moisture and alcohol initiate its decomposition. All bottles should be thoroughly cleaned and dried before the solution is placed in them, and, if alcohol is used for drying, it should be allowed to evaporate completely before the bottles are used.

4. Solutions left over from a series of dressings should never be returned to the stock bottles, for in them decomposition has started and, if introduced into the stock solution, it in turn will decompose.

5. Bottles in which the solution has already undergone decomposition should be carefully cleansed with hot water and thoroughly dried before using again.

6. Nothing should be allowed to come in contact with the stock solution. It should always be poured into a second container from which it can be taken with droppers, pipettes, syringes and cotton applicators.

THE ADVANTAGES OF THE USE OF PICRIC ACID OVER TINCTURE OF IODINE for disinfection of the skin are given by Gibson.¹⁰⁴ From his experience at a British Casualty Clearing Station, he became familiar with the use of 5 per cent. picric acid as a substitute for iodine in skin disinfection. From his experience at the New York Hospital, he is convinced that the solution should replace tincture of iodine. Similar enthusiasm has been personally expressed by many of the American Surgeons who have worked with the British. It has all the advantages of iodine and none of its drawbacks. It is also very cheap. "Prior to its use on the operating table, the skin can be shaved with soap lather and scrubbed with soap and water as much as may seem desirable. It should be allowed to dry before the operation is begun."

TENDONS.

Tendon Transplantation. Bernstein¹⁰⁵ declares that the usual methods of tendon transplantation are all open to the following criticisms: (a) In all of them, the healthy tendon (whether anastomosed to the diseased tendon or directly implanted in its new insertion) is first isolated from its normal anatomic surroundings. (b) As a result, the tendon, with its surrounding structures, is subjected to a greater or less amount of operative traumatism. (c) Little care is taken in all of the usual transplantation methods, to provide for the transplanted tendon any environment comparable to its previous position. Lovell and Tanner¹⁰⁶ have described the synovial coverings of the tendon as elongated synovial sacs into which the tendons are completely invaginated, and they

¹⁰⁴ *Annals of Surgery*, February, 1919, No. 2, lxix, 127.

¹⁰⁵ *Surgery, Gynecology and Obstetrics*, July, 1919, No. 1, xxix, 55.

¹⁰⁶ *Journal of Anatomy and Physiology*, London, 1908, series 3, xliii, 415.

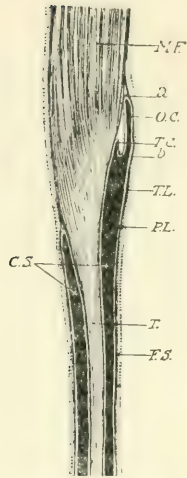


FIG. 67.—Diagrammatic longitudinal section through the end of a typical synovial tendon sheath (modified from Lowell and Tanner). *T*, tendon; *M.F.*, muscle fibers; *F.S.*, fibrous sheath; *S.C.*, synovial cavity; *P.L.*, parietal layer of synovial membrane; *T.L.*, tendinous layer, corresponds to the epitendon; *O.C.*, osseofibrous cul-de-sac-plica duplicate; *T.C.*, tendinous cul-de-sac; *a*, first reflection of parietal layer of synovial membrane (superficial pocket of plica); *b*, upward reflection of same (deep pocket of plica). (Bernstein.)

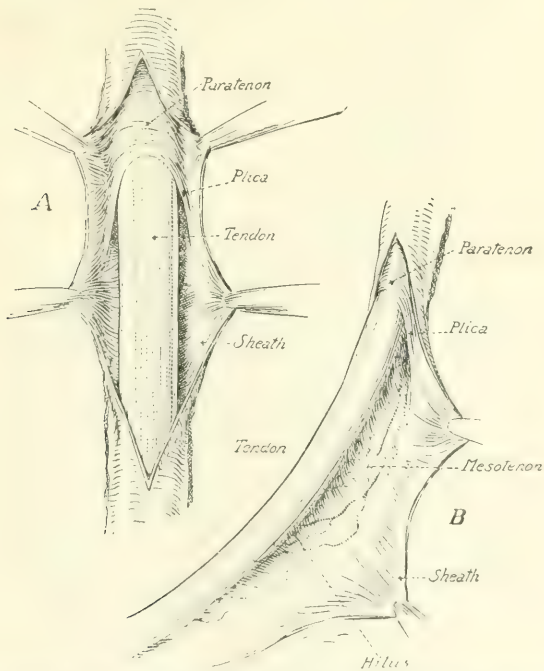


FIG. 68.—Extensor longus hallucis tendon. Sheath is opened exposing the tendon and showing the finer anatomical structures. *A*, anteroposterior view; *B*, lateral view showing the mesotenon and hilus. (Bernstein.)



FIG. 69.—Microscopic section of a transposed tendon through the sheath of another tendon of a dog; twenty-one days' duration. *A*, tendon; *B*, sheath. Notice the organization of the exudate with fibrous tissue formation in the sheath. In *B*, high magnification, is shown a proliferation of the sheath wall and the formation of new blood capillaries. (Bernstein.)



FIG. 70.—This is a cross-section of a transposed tendon through the sheath of another tendon, two weeks' duration, 16 objective, 2 oc. *A*, tendon; *B*, sheath; *C*, epitenon. Notice the inflammatory products filling in the sheath. (Bernstein.)

have shown that the function of these sheathes is not only to make possible the gliding and stretching action of the tendons but also to provide nutrition and blood supply to them.

The consensus of opinion at the present time appears to be that though tendon transplantation is a practical and valuable surgical procedure, none of the present methods gives satisfactory end-results

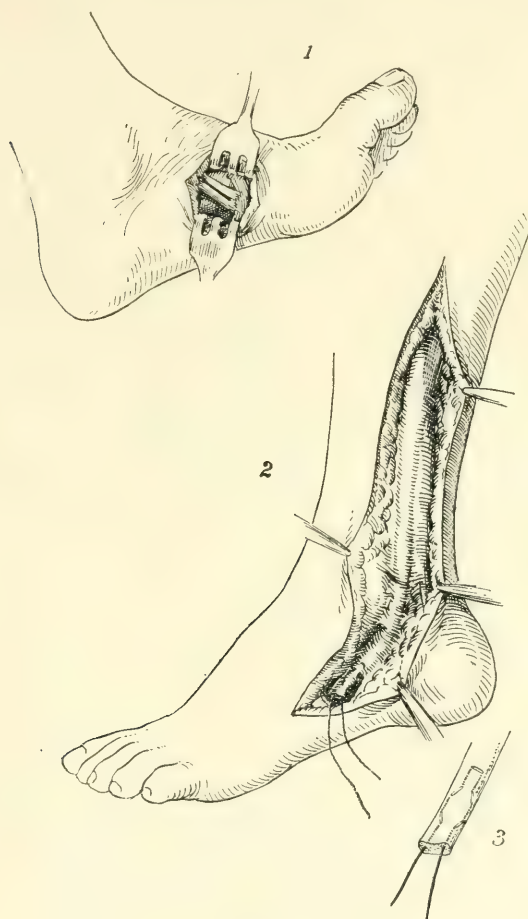


FIG. 71

and largely because of the dense adhesions which form about the transferred tendon as is shown in Figs. 69 and 70. As a result of his experimental work, Bernstein is convinced, and his photographs certainly demonstrate the fact, that these adhesions can be prevented if the tendon is removed with all of its normal anatomical surroundings, sheath and fat.

NERVES.

Lesions of Peripheral Nerves. A collective review of this subject is found in the *International Abstract of Surgery*, February, 1919, p. 105, by Major Corbett, from which the following is freely quoted:

Every wound of a peripheral nerve should be recognized at the earliest possible moment and immediate treatment instituted. Lyle¹⁰⁷ has

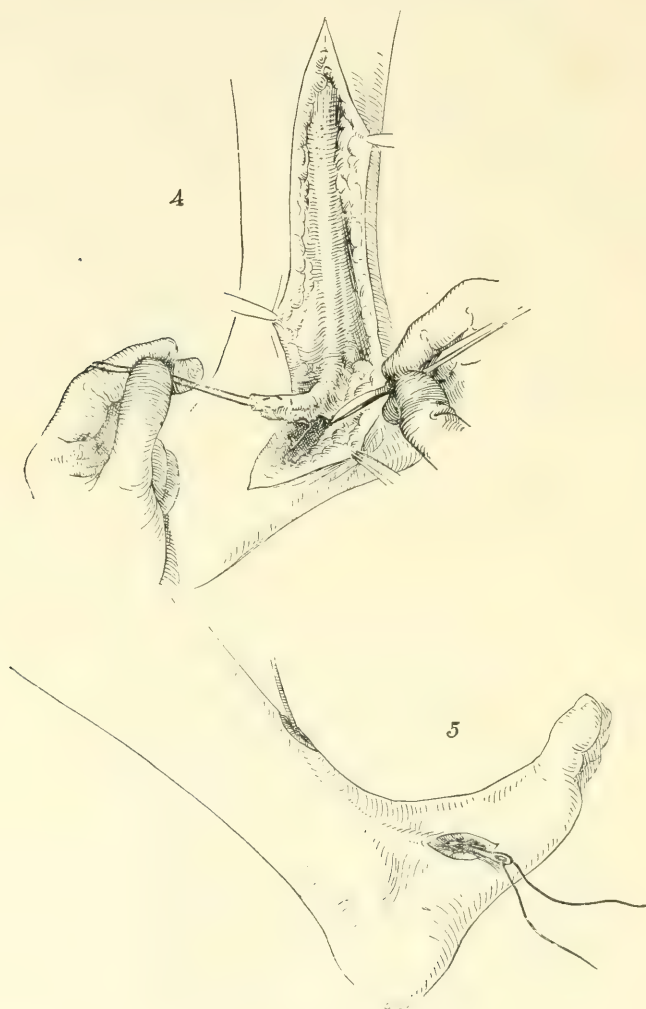


FIG. 72

stated, "It is imperative, whether a nerve is divided or not, that paralyzed muscles be relaxed and protected from strain by suitable apparatus. This postural prophylaxis begins with the receipt of the wound and

¹⁰⁷ *Surgery, Gynecology and Obstetrics*, 1916, xxii, 127.

continues after operation until voluntary movement is restored." But Tinel¹⁰⁸ sounds a very necessary warning that there are dangers to postural apparatus, and care should be taken to avoid, when using them, the overstretching of paralyzed muscles, and that permanent fixation of

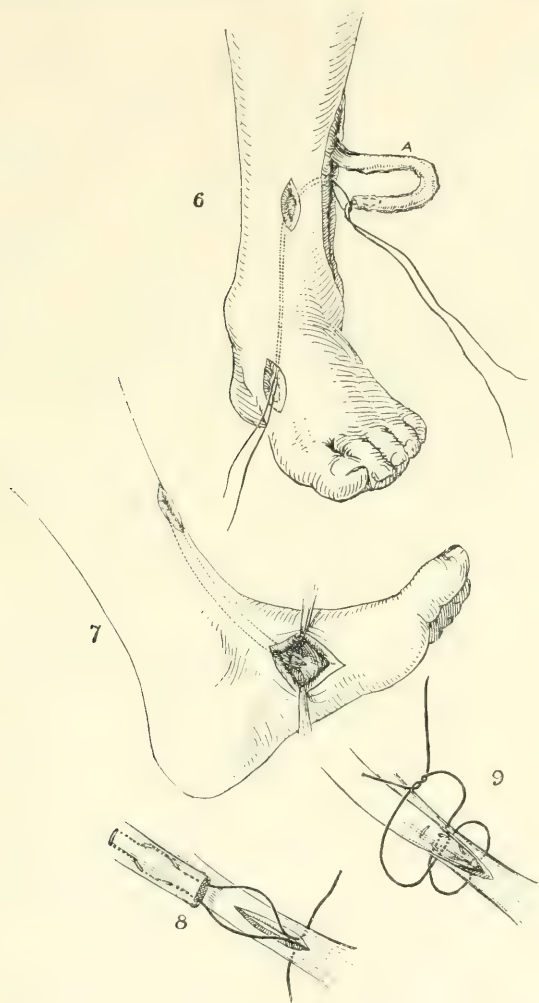


FIG. 73

FIGS. 71, 72 and 73.—The method of tendon transposition of peroneus longus to replace a paralyzed tibialis anticus. (Bernstein.)

tendons or joints must be prevented by frequent removal of the apparatus, allowing early massage, which should be given daily to every paralyzed muscle. Various splints have been devised and recommended, but, for all practical purposes, carefully moulded plaster gutter-splints

¹⁰⁸ Nerve Wounds, William Wood & Co., New York, 1917.

have met all requirements in many of the reconstruction centers of the American Army.

While considerable difference of opinion exists among surgeons as to the proper time of the secondary operation, all agree that at the primary operation every nerve found completely or partially divided should be repaired. The ends should be freshened or partially resected, and immediate suture should follow. Such immediate sutures give excellent results, and, even if they fail, a secondary resection can be done later when the wound is healed.¹⁰⁹ The possibilities of spontaneous recovery, which are many times surprising, and the ever-present danger of latent infection in gunshot wounds argue for delayed radical surgery. It is equally true that, with the increasing interval of time, the chance for the certain improvement offered by early neurolysis decreases. Willems¹¹⁰ explores all cases immediately. Tinel¹¹¹ advocates no intervention until it can be clinically proved that there is complete interruption or simple compression, this often requiring two or three months, but when the diagnosis is made, operation should be immediate. With proper postural, mechanical and electrical treatment, Tinel reports that 60 per cent. of nerve lesions will recover spontaneously. His indications for operation are as follows:

1. Absence of regeneration.
2. Defective or partial regeneration.
3. Complete interruption.

The danger from latent infection in all war wounds has not only been recognized but emphasized again and again by Hoffman,¹¹² Bond¹¹³ and Moynihan.¹¹⁴

From the point of view of the pathology of nerve wounds, Sherren classifies them into physiological interruption and anatomical interruption. The concussion of the nerve referred to by Tubby¹¹⁵ is a form of physiological interruption in which there is no actual destruction of the axis cylinders. This may be in the form of anemia, hyperemia or actual effusion of blood between the nerve fibers, or it may take the form of inflammatory exudate. In all these cases, the degree of absorption of the exudate and the final amount of connective-tissue scar determines whether the interruption is physiological or anatomical.

When cut nerves are allowed to heal after complete or incomplete severance, there is an enlarged bulb at the site of injury which grows from the proximal segment, and is known as a neuroma. This is the growth of an entanglement of regenerated nerve fibers and follows an attempt of the axis cylinder to penetrate the connective tissue separating it from the distal segment. Complete anatomical interruption of the nerve results in so-called Wallerian degeneration of the distal segment which is a death of the axis cylinders. The medullated fibers of the proximal stump, however, do not degenerate for more than 1 mm., while the non-medullated degenerate for a distance of more than 1 cm.

¹⁰⁹ Delagenière: Bull. et mém. Soc. de chir. de Paris, 1918, xlv, 522.

¹¹⁰ Deutsch. med. Wehnschr., 1915, xli, 1417.

¹¹² München. med. Wehnschr., 1916.

¹¹¹ Ibid.

¹¹³ British Medical Journal, 1915, ii, 467.

¹¹⁴ Surgery, Gynecology and Obstetrics, 1917, xxv, 595.

¹¹⁵ British Medical Journal, 1915, i, 57.

Regeneration is now generally considered to occur by a down-growth of the axis-cylinder from the proximal portion, the new axis-cylinders from the proximal end trying to find their way into the distal segment of the nerve. When this is prevented by scar tissue, or by the lack of apposition of the proximal or distal ends of the severed nerve, excision of all the scar tissue, and bringing together the ends of the nerve trunk and suturing into anatomical apposition has demonstrated, clinically at least, the provision of an uninterrupted path for the down-growth of the axis-cylinder process. It is this procedure which has given the best results in the war. Tinel¹¹⁶ reports, in 1917, 180 cases which he was able to follow, in which there were only 14 failures.

When the loss of nerve substance by the original injury or operative excision makes suture difficult, liberation of the nerve and changing the posture of the limb will provide 1 or 2 cm. Stretching of the nerve may provide as much as 4 to 5 cm. The resection of the scar tissue should be complete, if possible exposing normal nerve fiber.

To recognize normal cut nerve tissue from scar tissue, Dujarier has made the following comparisons: "Scar has no fasciculi, it glistens, is homogeneous, has little or poor blood supply when compared to the normal nerve. On the other hand, the nerve has fasciculi that on cross-section appear as small circles of hyalin, and there should be free bleeding from minute bloodvessels. The nerve ends should be brought together without twisting or altering their anatomical relationship. As to suture material, various kinds have been used and suggested, but the practice in the American Army at the end of the war was to employ fine silk on round needles, such as is used in bloodvessel anastomosis. The sutures should penetrate only the nerve sheath. They should be interrupted and placed about 3 mm. apart. Intraneural hemorrhage after section is sometimes difficult to control, and the safest method has been that of Dujarier who uses hot saline compresses.

There are definite dangers from the use of the tourniquet. In the resulting dry wound the tissues will suffer damage. Anemia of a limb for over two hours is dangerous, and the pressure of a tourniquet on the nerve for that length of time may cause paralysis. Intraneural bleeding is more apt to be overlooked, and postoperative hemorrhage and hematoma more likely to occur.

Whenever it is possible, the cut ends of a nerve should be approximated.

Souttar and Twining¹¹⁷ may be quoted as saying: "We would lay very great stress upon the superiority of end-to-end suture over all other methods in dealing with a divided nerve. In very rare cases anastomosis to another nerve may be justifiable, but, in the present state of nerve surgery, it should only be done with the clear understanding that an experiment is being performed." Hutchinson, Feiss and Price, after their experience with 280 operated nerve wounds at the American Ambulance, did not have a single recovery of function in cases of anastomosis to a normal adjacent nerve. "As to grafts, in spite of the

¹¹⁶ British Medical Journal, 1915, i, 57.

¹¹⁷ The British Journal of Surgery, October, 1918, No. 22, vi, 287.

prominence that is given to them, we know of few cases—the records of which will stand investigation—in which a successful result has been obtained.”

Thus, Dujarier¹¹⁸ reports 20 cases of homoplastic grafts: “It is too early to speak of final results which will be reported later.”

Delagenière¹¹⁹ reports the use of musculocutaneous homografts in 9 cases, in 3 of which there was almost complete success.

When impossible to approximate the cut ends of the severed nerve a bridge must be provided. Of all the methods suggested—nerve crossing, nerve anastomosis, the bridging with foreign bodies and tubular sutures—nerve transplantation is the only one which has stood the test of clinical experience during the war and free homografts have given the best results.

Neurolysis, a freeing of the nerve from compression by scar tissue, has given the most brilliant results in the war.

Operations upon Peripheral Nerves. Complete editorial comment is found in the *Annals of Surgery* (No. 2, February, 1919, vol. lxix, p. 190), upon the reports of the Inter-Allied Surgical Congress for the Study of the Wounds of War, Third Session, 1917. Gosset gives a valuable statistical report upon operations done on 2011 nerve trunks, the most valuable part of which is his analysis of the causes of failure after operation. Reoperation has shown that, except in cases in which, at the time of the first operation, the separation was too great, many failures are due to faulty operation. Faulty methods which should be abandoned, such as *suture à distance* or suture by doubling back a nerve flap; insufficient resection of cicatricial nerve ends, which has resulted in a fibrous cap forming upon one or both extremities of the nerve through which the axis cylinders could not pass; lack of care in preserving the axis of the nerve when approximating the ends; sutures not having been carried entirely through the neurilemma; forcible coaptation of the nerve end by the sutures thus producing a turning back of the axis cylinders; insufficient care in preparing the proper bed for the nerve, and incomplete resection of surrounding fibrous tissues or bony outgrowths; finally a mistaking of the real nerve lesion.

Mechanical Treatment of Peripheral Nerve Injuries. Stookey¹²⁰ says that in no class of organic injuries does the personal element of the surgeon more profitably enter than in the mechanical treatment of peripheral nerve injuries. Constant effort, especially in the early stages of regeneration, should be devoted to the use and reëducation of the paralyzed muscles. Frequently, there is superimposed upon an underlying organic lesion a functional disorder which in itself is many times more trying to handle than the nerve injury. This mechanical treatment is both preoperative and postoperative, and should attempt to maintain the nutrition of the part and prevent overstretching or contraction of the muscles paralyzed or contractures of their antagonists. A muscle which has been permitted to be overstretched may not regain its contractility, even after neurotization, and hence there may not be a

¹¹⁸ Bull. et mém. Soc. de chir. de Paris, 1918, xlv, 43.

¹¹⁹ Ibid., 522.

¹²⁰ Surgery, Gynecology and Obstetrics, No. 5, xxvii, 510.

return of motive power, even though the nerve be sutured. A paralyzed and overstretched muscle loses more permanently its contractility and undergoes more marked regressive changes than a paralyzed muscle in which overstretching has been prevented. Therefore, the first cardinal principle of the mechanical treatment of peripheral nerve injuries is to obtain relaxation and prevent overstretching of the paralyzed muscles.

There are two main types of apparatus: (1) Those which aim to prevent overstretching and correct faulty position; and (2) those which attempt to replace a part of the lost movement. And the cardinal principle in the application of splints is that they should be altered and changed according to the stage of progress and repair of the paralysis. The importance of this mechanical treatment is shown by a report of Laquerriere and Peyre to the effect that in fully 50 per cent. of cases reporting for physiotherapy, deformity might have been avoided by proper splinting and by surgical interference not too long delayed. This was all too evident in the early years of the war, but toward the latter part its importance was appreciated both in the French and in the English Armies, and though the results in the American wounded are not all that they might have been, those which we have personally seen in the reconstruction hospitals in this country are gratifyingly better than one saw in the other armies abroad. Stookey wisely cautions against the danger of pressure sores, particularly in cases of contractures and where there is scar tissue, for it must be remembered that anesthesia is frequently present in both the superficial and deep parts, and the usual warning of pain may not be given.

Early Mechanical Treatment. Where immediate repair has not been possible, the extremities should be put in such a position that the severed ends may be brought into as close proximity as possible and held there for a few weeks until the ends become anchored in the surrounding tissue.

Correction of the Deformity before Operation. Prior to operative interference in nerve injuries, all contractures must be overcome and free mobility of all joints obtained. Contractures and adhesions should be stretched.

Electricity, Massage and Baths. The galvanic current is most serviceable and should be used daily to stimulate each group of paralyzed muscles to contract. All forms of massage should be tried, and contrast baths are supposed to be of value when there is much scar tissue. They probably improve nutrition, prevent degenerative changes in the tissues, and maintain muscle contractility and lessen pain.

Reëducation and Passive Motion. During the early period there should be passive motion of each group of muscles, but later on active exercise. In the army, the grouping of men with similar injuries and at the same stage of progress has proved very useful. In the early stages of recovery, there is a great need for constant effort at reëducation and muscle training of all the paralyzed muscles. This is especially true in nerve injuries, since it is rarely ever that the same funiculi are united at operation, and, therefore, the new axes must not only form new end-plates, perhaps in a strange muscle, but also new cell groups in the anterior horns and higher centers.

The Surgical Treatment of Progressive Ulnar Paralysis. Adson¹²¹ states that progressive ulnar paralysis has so rarely been treated surgically

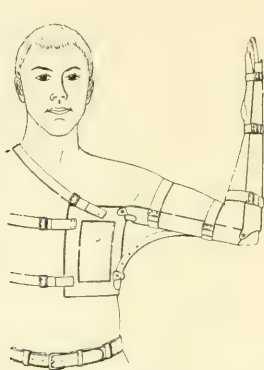


FIG. 74

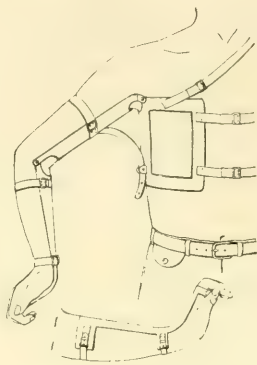


FIG. 75

FIG. 74.—Adjustable abduction splint with adjustable forearm piece for paralysis of the fifth and sixth cervical nerves. The arm is held in abduction and external rotation with the hand in supination. By altering the pin and lever to the arm piece the arm can be held in any desired angle of abduction. Forearm piece may also be adjusted by screw lock to various degrees of flexion. The splint is made of aluminum and lined with felt. (Stookey.)

FIG. 75.—Author's splint for total and partial paralysis of the musculospiral. *A* (above), adjustable aluminum abduction splint in the forearm piece to maintain the wrist in dorsiflexion. Arm held in abduction with the wrist dorsiflexed. *B* (below), small dorsal skeleton splint (similar to Jones's splint only dorsally placed) to prevent wrist-drop. Consists of a narrow dorsal piece and annular portion extending across the proximal phalanges of all five fingers. By being dorsally placed greater freedom is given to the palm. Note angle of elevation of the wrist. (Stookey.)

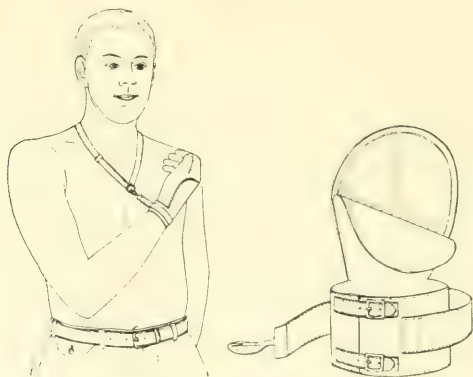


FIG. 76.—Author's wrist strap for paralysis of the musculocutaneous. *A* (at left, arm held in semiflexion and drawn across to the opposite shoulder. Hand is held in supination. Metal dorsal extension piece supports the hand and prevents it from falling into dependent position. The small strap about the wrist is attached only to the volar surface on the radial side and passes under the wrist, thus assisting in maintaining supination. *B*, to illustrate wrist strap and metal extension, leather is ripped and turned back showing metal piece which extends from wrist across dorsum of hand. Note line of attachment of small wrist strap and that it passes under and behind the wrist. (Stookey.)

¹²¹ Collective Papers of the Mayo Clinic, 1918, vol. x.

because it has been diagnosed as a progressive muscular atrophy and a form of muscular dystrophy. The operative findings in a number of cases at the Mayo Clinic, in which there was a single progressive ulnar

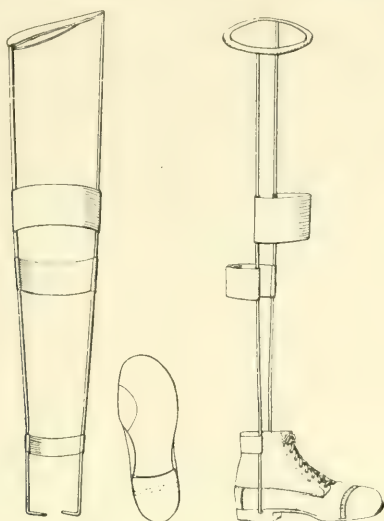


FIG. 77

FIG. 78

FIG. 77.—Thomas's caliper for paralysis of anterior crural. Note angle at which caliper should be inserted into shoe so as to obtain slight inversion of foot. The shoe is elevated on inner border so as to deviate body weight and lessen the strain on knee-joint. A spring lock may be used to permit flexion on sitting. (Stookey.)

FIG. 78.—Thomas's caliper for total paralysis of the sciatic. Fixed iron and sole plate to maintain the foot slightly dorsiflexed and prevent toe drop. (Stookey.)



FIG. 79.—Short caliper for paralysis of both internal and external popliteal. *A* (at left), outside iron with metal sole plate (indicated by dotted lines) extending from heel to metatarsophalangeal joint. *B*, the same, with $\frac{1}{4}$ inch elevation on sole and heel and inside strap to prevent valgus deformity and lend support to the angle. (Stookey.)

paralysis, without any other form of paralysis or atrophy, presented marked interstitial neuritis with a diffuse thickening of the nerve as well as nodular masses like neuromas.

1. The conclusion is that progressive ulnar paralysis is a definite clinical entity, the result of a slight trauma—a bruising or stretching of the ulnar nerve over small bony prominences in the region of the nerve.



FIG. 80.—Caliper for paralysis of external popliteal. A (at left), inside iron with fixed sole plate and stop lock to prevent toe drop and yet permit flexion of the ankle. Foot held slightly dorsiflexed to give greater facility in walking. B, the same, outside elevation of sole and heel and outside angle strap to prevent varus deformity. (Stookey.)

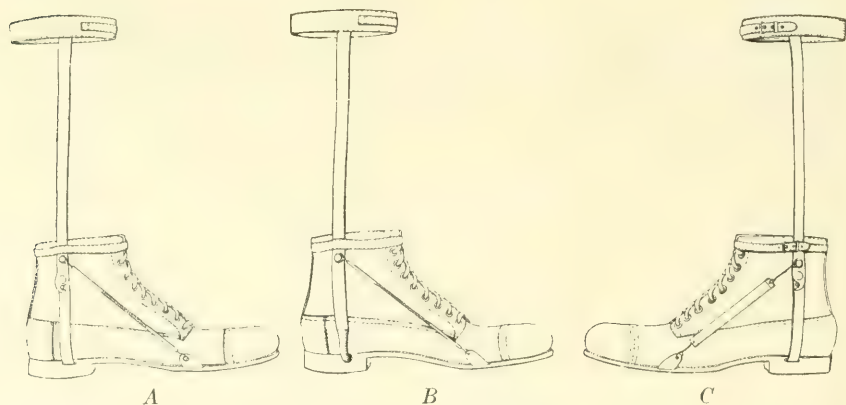


FIG. 81.—Author's spring device to replace extension in foot drop. A, inside iron with fixed sole plate and stop lock is fitted with metal spring or rubber band extending from above center of astragalo-tibio-fibular articulation to beyond metatarsophalangeal joint. The dorsal pull of spring replaces the action of the extensors so that walking is done with greater facility and ease. The inside iron and ankle strap and elevation of shoe correct the associated deformities. B, the same without stop lock or sole plate. Inside iron fits into a socket in the heel. It is fitted with spring device similar to that in A. C, outside iron fitted with rubber device to replace extension in paralysis of both internal and external popliteal. Stop lock and sole plate prevents plantar flexion. (Stookey.)

2. The condition is characterized by: (a) sensory changes—paresthesias and anesthesia, and (b) atrophy of the muscles involved, with gradual increase of motor paralysis.

3. The surgical treatment consists of transference and fixation of the nerve to a position internal to the inner condyle, with longitudinal

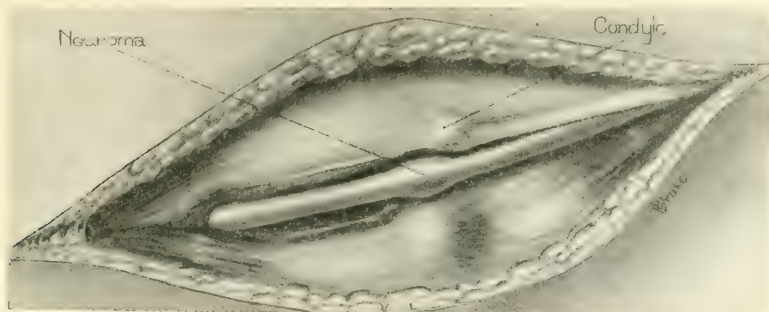


FIG. 82 (82214).—Exposure of the ulnar nerve with a neuroma due to trauma, without division of the nerve, associated with an old fracture of the elbow.

splitting of the epineurium and perineurium or the resection of neuromas followed by anastomosis.

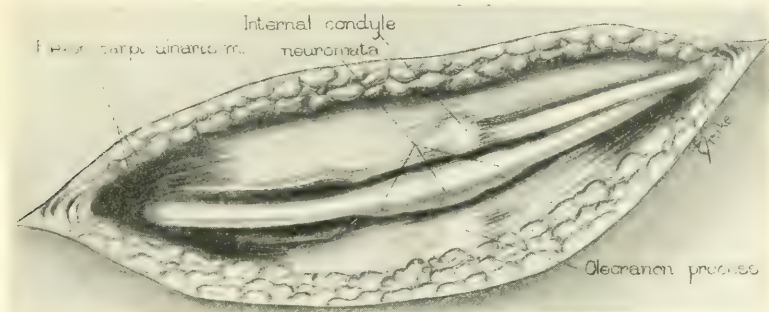


FIG. 83 (220582).—Exposure of the right ulnar nerve in position, illustrating three small neuromas in the nerve, due to trauma without severance of the nerve or fracture of the elbow.

BLOODVESSELS.

Wounds of the Bloodvessels. In the *United States Naval Medical Bulletin*, Special Number, January, 1919, Bainbridge points out that the projectiles of war may give rise to (*a*) contusions, (*b*) wounds of the bloodvessels. The wounds may consist in complete division, lateral openings or through-and-through perforation.

Contusions may be followed by thrombosis, which condition often remains undiscovered until an embolism or secondary hemorrhage occurs. Wounds of the vessels usually are accompanied by severe external hemorrhage if the overlying soft parts are open, as in an extensive wound, but if the wound of the vessel is situated in the course of a narrow track, a diffuse hematoma usually results. At a later date, arteriovenous aneurysms may develop as a consequence of vascular lesions previously overlooked or having escaped treatment.

Bainbridge directs that arteriothrombosis should be treated by ligatures placed around the vessel above and below the limits of the clot. He advises against arteriotomy and evacuation of the clot, and rightly so, considering the ever-present danger of infection in war wounds. In wounds of the vessel, he speaks of the ideal procedure of suturing the vessel, but acknowledges the limited opportunities because of infection and the mechanical difficulties presented in the massive war wounds.

Vascular Wounds and Their Immediate and Late Complications in War Surgery. Okinczy¹²² gives as indications for exploration of the vessels in traumatic wounds: (1) the trajectory of a projectile crossing a vascular line; (2) the radioscopic examination which localizes a projectile in, or near, a vascular area; (3) spontaneous or provoked pain in a vascular area.

Despite the fact that Makins, and others, have shown much more favorable results from simultaneous ligature of artery and veins than from ligature of artery alone, he is not convinced of the advantage of this method. This was certainly the experience of the surgeons at the American Ambulance at Neuilly, where the greatest care was taken to avoid the ligature of veins.¹²³ He feels that vascular suture is the procedure of choice when circumstances permit its application. The operation is long and difficult, and it must be done in healthy tissue.

Barbanoux¹²⁴ reports 108 cases in which femoral artery and vein, or the femoral artery alone were ligated and only 8 per cent. of them developed gangrene. His explanation is the rapidity with which collateral circulation is developed. When the external iliac system is obstructed, the blood flows into the internal iliac circulation and is distributed to the leg by the collaterals, the hypogastric, the obturator, and others.

Several reports are found of arthrotomy and also of removal of the missiles from the ventricles of the heart, as described by Patel.¹²⁵

The Suture of Bloodvessel Injuries Caused by Projectiles. Goodman's¹²⁶ statement that, when possible, a suture of an injured artery is preferable to ligation, is self-evident and it is particularly desirable in wounds of the popliteal artery. The technic of vascular suture outlined by Goodman consists of the following steps:

1. A free exposure of the injured vessel.
2. A temporary occlusion of its lumen above and below the lesion, either by flexible clamps, serrefines or tape.
3. A thorough perfusion of the intervening segment with Ringer's solution or saline solution followed by liquid paraffin.
4. A removal with scissors of the adventitia encroaching upon the line of suture.
5. Silk sutures threaded on fine cambric needles and sterilized in liquid paraffin should be introduced through both media and intima, carefully avoiding the adventitia.

¹²² Jour. de chir., Paris, 1918, No. 14, p. 441.

¹²³ Transactions of the Philadelphia College of Physicians, 1916.

¹²⁴ Marseille méd., 1918, lv, 720.

¹²⁵ Paris Medical Journal, 1918, xxvii, 125.

¹²⁶ Surgery, Gynecology and Obstetrics, No. 5, xxvii, 528.

6. A deep vessel, requiring repair, may be rendered more accessible by lifting the vessel from its sheath upon two narrow ribbons. This procedure may entail a division and ligation of one or more of the branches which hold the vessel in its normal anatomical position.

7. A walling off of the remainder of the wound with pledgets of black silk will assist materially in safeguarding the line of suture from thrombokinase, and will also serve to make the delicate white sutures more visible.

8. When the main artery is completely severed, a circular suture should never be attempted unless the severed ends can be approximated without tension. When this is not possible, a segment of a vein can be transplanted, or, when such a procedure is not practical, a paraffin tube may bridge the gap and maintain the blood supply until an enlarged collateral circulation is established.

Infective (Secondary) Hemorrhages from War Wounds. Neuhof and St. John¹²⁷ consider that the vague term "secondary hemorrhage" should be replaced by "infective hemorrhage," as their work demonstrated infection to be the sole cause of hemorrhage in those classified as secondary. Infective hemorrhage occurred in 1 per cent. of 5000 cases passing through their hospital, but its incidence is better expressed as 2.79 per cent. of 2332 operations. It occurred most often when conservative or no operative procedures were employed in the treatment of the wound. It is difficult to state when the danger of infective hemorrhage is passed, one of their cases occurring twelve weeks after the wound was received. The average time, however, was 12.8 days. Infection was present in every case in their experience. In none of their cases were they able to demonstrate infective hemorrhages from veins.

Pathologically, the artery, in cross-sections, is imbedded in infected granulation tissue, and there is a polynuclear cell invasion of the adventitia, edema of the muscular coats down to the immediate vicinity of the rupture, and, as the defect is approached, the muscle bundles show degeneration merging into complete necrosis. It is here that intense leukocytic invasion of the muscular coat is seen. The open lumen of the vessel is either U- or V-shaped, frequently containing a thrombus of varying size, always infected, and of fairly or very recent origin in the majority of cases. The organisms are usually found in the peripheral zone of the thrombus and adjacent portions of the vessel wall. They make the point that a primary wound of the artery need not be invoked to account for secondary hemorrhage from war wounds, and their feeling is that infection, and infection alone, is the common cause of secondary hemorrhage. In their suggestions for treatment, the main preventive measure is the adequate exposure by wound dissection of the main vessels so that the chemical sterilization may be directly applied to their sheaths.

If there is an infected area at the end of the stump, the artery should be tied off in a non-infected area, and if the main venous trunk is the seat of an infective phlebitis it should be excised beyond the thrombus.

¹²⁷ Surgery, Gynecology and Obstetrics, August, 1919, No. 2, p. 29.

They strongly advocate the surgical approach to the artery whenever feasible, through a separate incision, its double ligation proximal to the rupture and infected tract, and resection of the portion between the ligatures. They also advocate the ligation of the accompanying vein with the artery. Thus there still exists a difference of opinion as to the advisability of ligating the vein. To again refer to a personal experience in which 38 great vessels were ligated for secondary hemorrhage and in which the artery alone was tied, in only one case did gangrene result, and this was a case of ligation of both common femoral arteries for compound fractures of both femora in the same soldier. In this case, gangrene of one foot resulted, requiring an amputation at the middle third of the leg.

Their experience has shown how dangerous and often fatal it may be, with even the slightest degrees of infected hemorrhage to temporize by packing the wound. Hemorrhage is almost certain to recur because it comes from an arterial lesion, except in superficial wounds in which the bleeding evidently comes from granulation tissue. The reviewer has passed through a personal experience of this sort in which temporizing measures were employed, and arrived at the same conclusion.

Neuhof and St. John feel that amputation is indicated in infective hemorrhage from the popliteal or posterior tibial arteries, especially if associated with fracture. A personal experience of ligation of the superficial femoral at the apex of Scarpa's triangle in 8 cases¹²³ of popliteal injury in which the limbs were saved, would suggest that this was too general a statement.

The September number of *War Surgery and Medicine*, 1918, vols. i and vii, contains an exhaustive review of the *vascular injuries in the war*. Attention is called to the anatomical and pathological difference in wounds caused by bullets and those resulting from shells. In vascular bullet wounds, three conditions are encountered which are of particular interest in vascular surgery:

1. Spontaneous hemostasis from cicatricial closure, more or less complete.
2. Diffuse hematoma.
3. Traumatic aneurysms.

Spontaneous hemostasis (so-called dry wounds). An arterial bullet wound is immediately followed by an escape of blood which is effused around the vessel. The rigid perivascular sheath and the collapse of the separated muscular fibers of the vessel wall prevent spreading of the blood very far. In this manner the blood coagulates rapidly in the immediate neighborhood of the vessel, forming a clot which closes the arterial wound like a cork. In complete division of the artery this spontaneous hemostasis is favored by the anatomical conditions where the retraction and curling up of the middle and internal coats within the adventitia obliterate the lumen of the artery. Following this preliminary hemostasis, cicatrization of the vascular wounds proceeds rapidly.

¹²³ Lee: Transactions of College of Physicians, Philadelphia, 1917.

Diffuse Hematoma. The so-called dry wounds are the exception in arterial bullet wounds, for, under the influence of repeated pulsation, the blood extravasates outside the vessels and gradually infiltrates beyond the sheath into the intercellular spaces and interstices of neighboring muscles. Once the perivascular tissue has given way, the infiltration continues until the pressure of the extravasated fluid equals the arterial tension. Owing to the fact that the bullet tracts in the different tissue layers do not correspond, the blood usually does not reach the skin and escape externally, and thus a diffuse arterial hematoma is formed according to Sencert.¹²⁹ These peri-arterial effusions of blood are known as diffuse aneurysms, false aneurysm, diffuse aneurysmal hematoma, or pulsating hematoma. The term originally applied to them by Cruveilhier, arterial hematoma, sufficiently described the condition. As these collections of blood organize, they become encysted, and are often mistaken for true aneurysms because of the white lamination which lines the internal surface of the sack, giving it the appearance of a vessel wall. The less fortunate course of encysted arterial hematoma is when it becomes infected.

Aneurysm (arterial, arterial-venous, aneurysmal varix). An arterial hematoma may be converted into a true aneurysm, according to Sencert, if its encircling wall becomes organized into connective tissue while its center becomes softened and gradually hollowed out into a cavity into which the blood stream enters with each heartbeat, and this cavity is usually more or less completely lined by endothelial growth from the arterial edges.

When the arterial bullet wound is associated with a wound of the accompanying vein, the orifices in the two vessels may correspond exactly and adhere so accurately that there is no appreciable effusion of blood around the vessels. This is not frequent, and, when it does occur it prevents the ligation of the communication and the reconstruction of the two vessels by a double suture. When the two orifices do not correspond exactly, a diffuse hematoma of varying degree forms which is gradually transformed into an encysted hematoma, the center of which is a channel of communication between the artery and the vein.

Wounds from shell splinters are divided by Sencert into two classes: (1) Those in which the external wound gapes widely; (2) those in which it is partially or completely obliterated. In the first type, of course, there is free hemorrhage. In the second type, a diffuse arterial hematoma develops as in a bullet wound. In the treatment of these aneurysms, Forgue¹³⁰ states that the ideal treatment consists in operating within a few days after the reception of the wound, and the evacuation of the clots and the repair of the wounds in the vessel walls. Usually, however, the treatment has been deferred until signs of aneurysm appeared. Operation in the second or third week is dangerous, because the surrounding tissues are infiltrated with inflammatory exudate. This should subside after the fourth week, and then is the most favorable time for operation, because there has not been time for hard scar tissue to

¹²⁹ Lyon Chirurg., 1917, xiv, 640.

¹³⁰ Rev. de chir., Paris, 1917, liii, 1.

form. Further, collateral circulation will have developed by that time and the danger of resulting gangrene will be slight if at the operation it is found necessary to tie the vessels completely.

The methods which he outlines are:

1. The ideal, which consists in the isolation of the arterial-venous communication, dividing it, and treating the two openings which result as lateral openings of the respective vessels and then closing them by suture. The same effect is secured by isolating the communication and then obliterating it by ligature or suture.

2. If both artery and vein cannot be conserved, an attempt should be made to conserve the artery. The vein is ligated above and below, and the intervening segment isolated down to the arterial communication; the artery is then compressed above and below by Crile plants, the venous segment cut away, and the opening in the artery closed by lateral suture.

3. The four-ligature method. The artery and vein are ligated above and below the aneurysm. The three dangerous localities for this method are (a) the bifurcation of the common carotid; (b) the point of division of the femoral artery; (c) the branching of the popliteal into the tibio-peroneal and anterior tibial trunks. To guarantee a cure, one must extirpate the segments of vein and artery together with the aneurysm. The Esmarch bandage should not be used, because suppression of the circulation in scar tissue makes it difficult to recognize the vessel.

Bastinelli¹³¹ reports a case of arteriovenous aneurysm of the right femoral artery in Scarpa's triangle in which a man made a complete recovery after lateral suture of the artery and vein.

Buquet¹³² reports an arteriovenous aneurysm of the femoral vessels in Hunter's canal, with a projectile in the sack, in which total extirpation of the aneurysm was done after applying four ligatures. A complete recovery resulted.

Attention has been called in a number of instances to the extensive *paralytic phenomena that may follow a vascular lesion* independent of any nerve injury. Burrows¹³³ describes the symptoms as follows: (1) Subjective sensation in the distal part of the affected limb. (2) Anesthesia, more or less of the "stocking" or "glove" type, and involving all kinds of sensation, including light touch, pin pricks, and deep pressure; (3) muscular paralysis; (4) in certain cases hardness and inelasticity of the muscles; (5) edema.

Burrows is not willing to accept as an explanation a pathology similar to the so-called Volkmann's ischemic paralysis, and suggests the term "Angiotic paralysis." He divides the cases into two groups: those which have the characteristics of ischemic paralysis, and the other group in which the paralysis seems to be of a reflex nature.

The ischemic cases are characterized by: (1) An arterial injury with obliteration of the distal pulse. (2) Subjective sensations of "pins and

¹³¹ Clin. chir., Milano, 1917, xxv, 110, reviewed in the International Abstracts of Surgery, 1918, No. 2, xxvii, 328.

¹³² Bull. et mém. Soc. de chir. de Paris, 1918, xlv, 870.

¹³³ British Medical Journal, February 16, 1918, p. 199.

needles." (3) Muscular paralysis; the muscles being hard and inelastic to the touch. (4) Anesthesia of a "stocking" or "glove" distribution and confined to the portion of the limb distal to the injury and involving all forms of sensation.

The reflex group have the following characteristics: (1) Arterial injury without complete blocking of the vessel. (2) Absence of "pins and needles" sensation. (3) Flaccid paralysis of the muscles which do not feel hard and inelastic. (4) Widespread loss of cutaneous sensibility.

Leriche¹³⁴ calls attention to the train of symptoms ordinarily characterized as trophic which are consequent to arterial ligation or injury and which include many of those described in Burrows' reflex group. According to Leriche, these symptoms are due to injury of the sympathetic mechanism of the arteries, and he advises that in all cases of ligation of the artery the vascular sheath should be deliberately divided by the knife before the ligation is applied. He calls this a peripheral sympathectomy, and has demonstrated that these trophic symptoms do not occur when vessels are ligated in this way. Further, he cites cases to show the immediate disappearance of all trophic symptoms after performing peripheral sympathectomy. The operation is described as follows: The artery is exposed and then the cellular sheath is opened in its long axis by a bistoury, the vessel is then isolated for 8 or 10 cm., and, as far as possible, is denuded of all adhering tissues for that distance. The wound is then closed by layer sutures of the overlying tissues.

Tenani¹³⁵ reports a case of *causalgia* (the reflex symptoms of Burrows) involving the upper limb. The exploration of the sheath and wall of the axillary artery showed them to be injured directly in the path of the projectile. On resecting the sheath of the vein and artery, the symptoms rapidly disappeared. Tenani feels that, in addition to the vascular sheath, the injury to the vessel wall itself plays some role in the symptoms.

FRACTURES.

Fractures of the Neck of the Femur. Henderson¹³⁶ gives us a review of the Collective Papers of the Mayo Clinic briefly summarized as follows: The teaching of our text-books against the breaking up of a so-called impacted fracture of the neck of the femur is based upon what Whitman says is usually a slight displacement, and real impaction is rare. Such authorities as Jones, Whitman and Ruth teach that impaction should be broken up in all cases. In skilled hands and in careful technic, if, after breaking up of the impaction, the fragments are held in abduction and contact according to the method of Whitman and Ruth, Cotton and Jones, and if such fixation of the fractured surfaces is maintained for three months and no weight-bearing allowed for six months, excellent results can be obtained. In a group of ununited fractures of the hip, treated at the Mayo Clinic, radical surgery was resorted to in 33 cases and in the latter

¹³⁴ Bull. et mém. Soc. de la Soc. de chir. de Paris, 1917, No. 5, xliii, 310.

¹³⁵ Policlin Roma, 1918, vol. xxv, sez. prat., 749, reviewed in International Abstracts of Surgery, 1918, ii, 417.

¹³⁶ Collective Papers of the Mayo Clinic, 1918, vol. x, Saunders & Co.

cases a bone peg, such as is described by Albee, was used. Their poorest results were with autogenous grafts taken from the tibia, and their explanation is that as these grafts were all cortical bone and were placed in cancellous bone, they believe that they were gradually replaced by

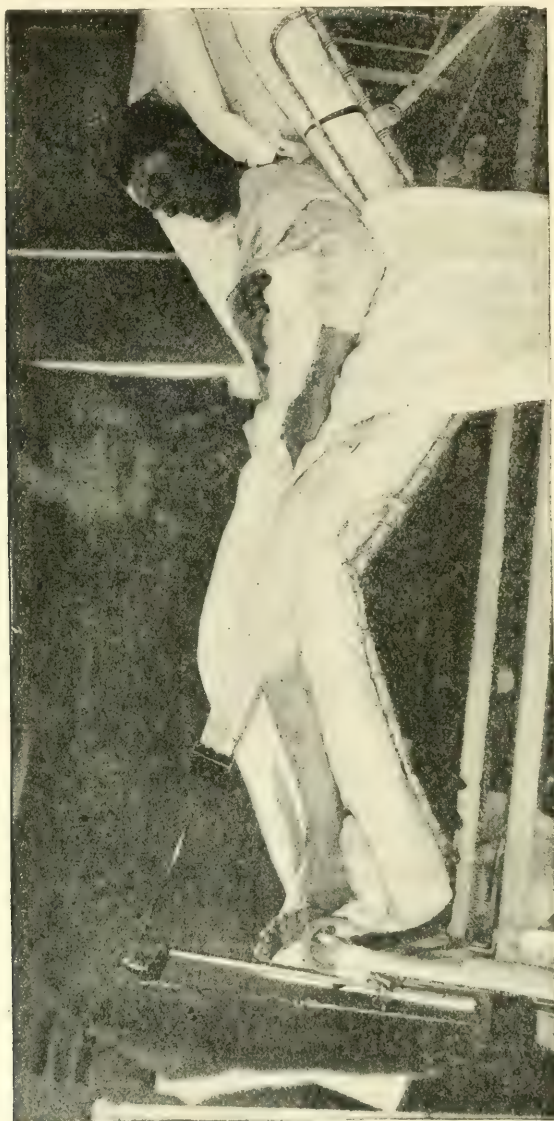


FIG. 84.—Showing arrangement of extension, position of patient and pad under heel. (Wise.)

bone natural to the situation. Their best results were with the fibulae, the entire thickness of the bone being employed.

ABDUCTION TREATMENT OF FRACTURE OF THE FEMORAL NECK. Whitman¹³⁷ suggests that the routine treatment of all fractures of the neck of

¹³⁷ Surgery, Gynecology and Obstetrics, December, 1918.

the femur be by the abduction method. The patient, clothed only in a fitted shirting or combination suit of underclothing and anesthetized, is placed upon a pelvic rest fixed to the end of the table and provided with a perineal bar for further extension, the shoulders resting on a box of

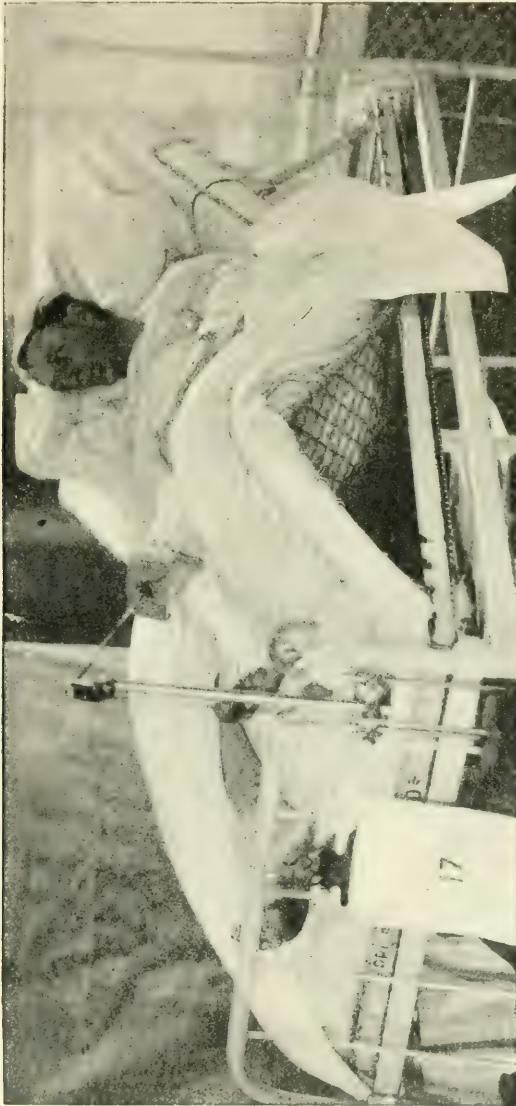


FIG. 85.—Showing abduction to the limit of the width of the bed. Sandbags in place. (Wise.)

equal height. The extended limbs are each supported by an assistant. The surgeon, standing on the inner side, lifts the thigh upward, guiding the trochanter to its normal position. When the shortening has been reduced, as shown by comparative measurements, the limb is slightly rotated until the patella points upward. The two assistants who have

up to this time exerted equal traction of the limbs then abduct them so that the tension on the capsule, as the fracture is adjusted, may not tilt the pelvis upward. The order of manipulation is: Direct manual reduction of the shortening, then outward rotation, then the abduction.

The typical attitude in which the limb is fixed after adjustment of the fracture is one of complete abduction, complete extension and slight inward rotation. The knee is slightly flexed, and the foot slightly abducted in a right angular relation to the leg. The spica plaster dressing should extend from the nipples to the tips of the toes and should be thick and unyielding about and below the joint, completely enclosing the buttock. The plaster spica is worn from eight to twelve weeks, and after its removal the patient remains in bed for several weeks for massage, passive and active movements of the joints, and reestablishment of muscular control. Weight-bearing should never be permitted for at least six months, because repair is slow and because the strain is much greater than in any other situation.

THE TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR. Albee¹³⁸ calls attention to the unsatisfactory results obtained by the old methods with Buck's extension and sandbags, only 15 per cent. having good function. In addition to Whitman's abduction method, which gives much better results than the former, he advocates the routine practice of inserting a bone peg in every operable case in which the fragments are loose or unimpacted.

FRACTURE OF THE NECK OF THE FEMUR IN THE FEEBLE. Wise¹³⁹ suggests that instead of neglecting the treatment of the fracture in case of fracture of the neck of the femur in the aged and feeble, as is generally the custom, they be placed on a Gatch bed, in a modified Fowler position which will provide the desired flexion of the thigh to place the muscles at rest; the necessary abduction and extension can be provided by the usual Buck's extension of adhesive plaster, applied to the flexed thigh, making the pull in the longitudinal plane of the thigh over a pulley attached to the corner of the foot of the bed.

The advantages of the above method of treatment are as follows:

1. It can be applied immediately after the injury even while the patient is in shock, thus preventing a certain amount of shortening.
2. The patient sits in a comfortable position and is not troubled by apparatus, such as a cast or splint, making it possible to give more attention to the skin and thus prevent bed sore.
3. It provides continuous extension no matter what position the patient assumes.
4. The immobilization is not so complete as to cause entire disuse of the muscles with the resulting loss of power seen after many weeks spent in a cast or splint. The getting on and off of the bed-pan, the daily bath and rub provide the necessary exercise to keep the muscles in a fair state.
5. It is easy to get the patient on and off the bed-pan.

¹³⁸ American Journal of Orthopædic Surgery, 1918, xvi, 493.

¹³⁹ Surgery, Gynecology and Obstetrics, August, 1919, No. 2, xxix, 201.

6. It can be applied with little or no assistance, and can be used in private homes.

7. It keeps the patient in a sitting position and guards against hypostatic congestion of the lungs and pneumonia.

It should be noticed that in the photographs the sole of the foot is resting against the rail of the foot of the bed and thus the necessary right-angled relation between the sole of the foot and the longitudinal plane of the leg is maintained. It is a question, however, if this could be continued for any length of time without a pad between the sole of the foot and the rail, and, from our experience with the gunshot wounds of the femur, as much attention should be paid, from the standpoint of preventing disability, to avoiding toe-drop as to the treatment of the fracture itself.

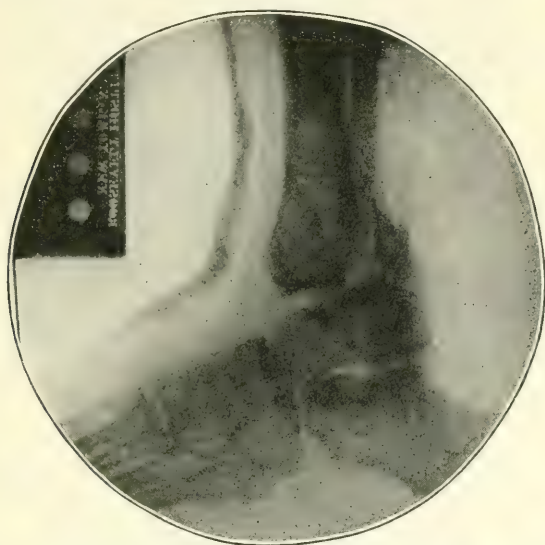


FIG. 86.—Comminuted Pott's fracture, showing posterior displacement of tarsus after deformity had been reduced under anesthesia and after a firm plaster-of-Paris dressing had been applied. (Dowd.)

Pott's Fracture. When, in a Pott's fracture, because of the extensive injuries to the malleoli, articulating surfaces and ligaments, a backward displacement of the tarsus occurs, a very crippling loss of function will occur if it cannot be corrected. Dowd¹⁴⁰ reports several such cases which he treated by tenotomy of the tendo Achillis. The x-rays before and after speak for themselves. Such a simple and harmless procedure should certainly be employed to prevent the inevitable disability which occurs from these fractures when not properly reduced, and without it the possibilities of complete reduction are very slight. Jones¹⁴¹ advocates it, and also Guichard.¹⁴²

¹⁴⁰ *Annals of Surgery*, September, 1918, No. 3, lxviii, 330.

¹⁴¹ *Injuries to Joints*, London, 1917, p. 147.

¹⁴² Tenotomy of the Tendon of Achilles for Fractures of the Limbs, Thèse de Paris, 1902.

Ununited Fractures. The vast experience which the gunshot wounds of bones in the war has provided is shown by Gosset's¹⁴³ extensive report

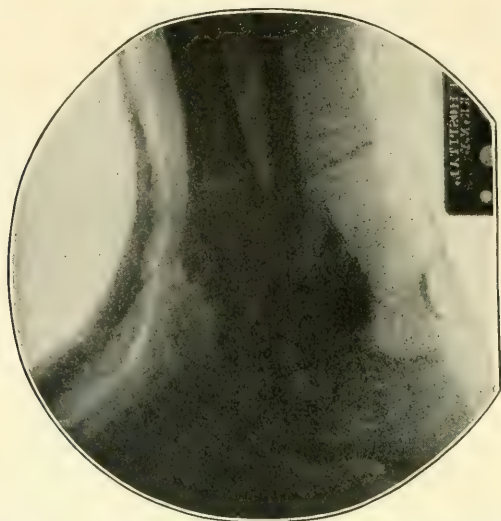


FIG. 87.—Comminuted Pott's fracture, showing posterior displacement of tarsus after second attempt at reduction under anesthesia and application of plaster.

upon this subject to the Fourth Inter-Allied Surgical Conference. His report is based on the study of 1765 cases of men who were either not

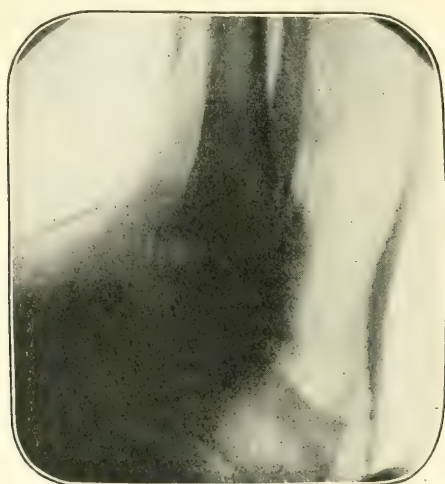


FIG. 88.—Improved position after lengthening the Tendo-Achillis and reapplication of plaster.

operated upon or unsuccessfully operated upon and pensioned on account of disability; 1658 were receiving pensions at the time of the report for

¹⁴³ Arch. de méd. et pharm. mil., Paris, 1918, lxx, 360.

ununion fractures of the upper limb and 107 of the lower limb. In the upper extremity ununion fracture of the humerus was the most common.

The factors causing ununion fracture in this group which were studied are given as follows: Loss of substance—48.9 per cent.; the presence of muscular or fibrous tissues between the fragments—20.5 per cent.; lack of anatomical approximation or prolonged infection—12 per cent.; loss of substance, faulty approximation and prolonged infection—10 per cent.; vasculotropic disturbances—3.1 per cent.; prolonged infection and vasculotropic disturbances—2.9 per cent. The most frequent cause was the loss of substance. This study, of course, is based upon results from the early period of the war, and there is no doubt that the later methods of wound sterilization and disinfection of the fracture, and, when possible, primary closure, would have improved these results by at least 50 per cent. as our later experience showed. In addition, where the x-ray shows faulty reduction of fragments, immediate reduction, and, if necessary, fixation by any of the accepted methods of osteosynthesis would definitely decrease this condition of non-union.

He divides ununion fractures into two groups for the purposes of treatment—with and without loss of bone substance. With the loss of bone substance a bone graft must be employed. Where there is no loss of bone substance, or where only one or two bones is involved, it is his practice to obtain fixation by means of metallic plates and screws. When using grafts, he waits until the skin wound is cicatrized and all signs of inflammation have disappeared, but with the osteosynthesis, the fixation may be applied at the end of the period of inflammation, even, if necessary, in non-aseptic areas.

Ununion Fractures of the Patella and Olecranon. Albee¹⁴⁴ suggests that for cases of long-continued non-union or mal-union, autogenous bone grafts be used. The graft is taken from the upper portion of the tibia and shaped like the letter H. For fractures of the olecranon he suggests a sliding bone graft taken from the distal portion of the humerus.

Compound Fractures. FRACTURES. Blake¹⁴⁵ states that: "Of all war injuries, the most important without doubt, both from a humanitarian and from an economic standpoint, are those of the bony skeleton; in other words, the fractures, and particularly those of the limbs." In civil surgery this is equally true of industrial accidents, and the improved results that it was possible to obtain in the latter months of the war because of the vast experience of such men as Blake, Jones, and Sinclair, will be of peculiar value in the future for industrial surgery. There is, however, a difference between war fractures and civil fractures. The war fracture is caused by the direct action of a missile, while the civil fracture is more often the result of an indirect bending or torsional force. The war fracture is open to infection, the bone is smashed by the projectile, fragments of bone are often detached and driven through the tissues, so that they actually form secondary missiles; foreign bodies, often loaded with infectious material, lie in or are disseminated among

¹⁴⁴ Surgery, Gynecology and Obstetrics, April, 1919, No. 4, xxviii, 422.

¹⁴⁵ Annals of Surgery, No. 5, lxix, 458.

the fragments; the soft parts are lacerated, even pulpified; in short, the conditions are all favorable for the severest types of infection." While these conditions were more or less constant in war wounds, it is equally true that some of them to a lesser degree are often present in our industrial injuries, and therefore the knowledge of their proper treatment, which has been almost entirely acquired during the war, can be applied to our industrial problems.

"The surgeon, in treating a compound fracture possessing these elements, has not only to keep the fragments of bone in proper position but also to contend with the worst form of infection. In addition to the immediate danger to life from sepsis, infection of a fracture causes death, or necrosis of the fragments and ends of the bone, the amount of necrosis usually depending upon the extent of interference with the blood supply produced by the injury. These dead pieces and ends prolong infection and hinder the processes of repair and union, and should be removed by operation. If the operations for their removal are not properly timed or executed, more bone may die or other complications follow. The gravity of the primary and secondary infectious processes can be greatly modified by the proper treatment."

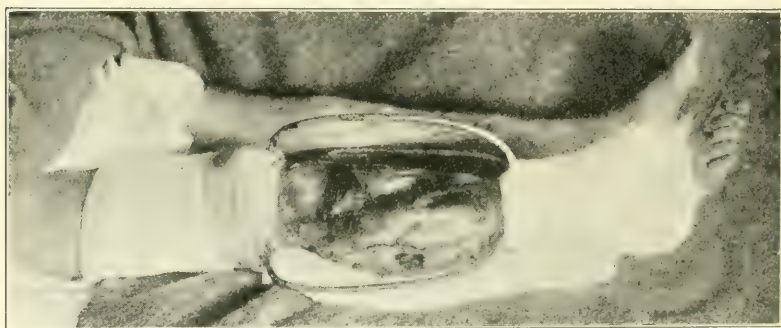


FIG. 89.—Compound fracture of tibia. Photograph taken after three months in the same plaster cast; non-union. Union one month after removing cast. (Lee.)

Blake then outlines the treatment of fractures during the early part of the war, based upon the cardinal principle of immobilization. To what Blake says of "The gangrene and often loss of life, the wasting of the limbs from disuse, the pressure sores and the filth which accumulated beneath the plaster-of-Paris dressings in which the limbs were encased to provide immobilization," to all of these horrible conditions the reviewer can testify from personal experience in 1915 and 1916. "If life and limb were preserved, in the best hands the union was but fair, with generally some shortening and the functions, almost without exception, lamentable; the joints were stiffened and the muscles wasted. In fractures of the thigh the results reported by some of the best clinics for the first year of the war show that less than 2 per cent. were fit to be returned to any kind of duty."

To Blake is due the credit of being the first to discard the old precepts

as to the immobilization and fixation in fractures, and the substitution of entirely different principles. "The underlying principle is that of the preservation of function." Later, Willems, in his treatment of infections of the joints, developed a treatment along the same lines. "The chief mechanical principle involved is that of traction. If traction be made on a broken limb in the direction of the axis of the proximal fragment

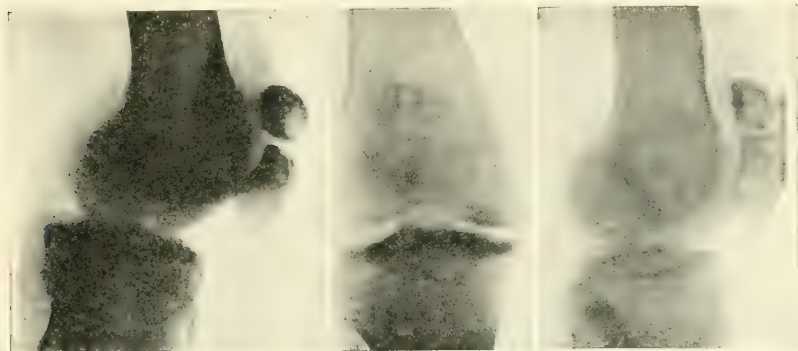


FIG. 90

FIG. 91

FIG. 92

FIGS. 90, 91 and 92.—Fracture of the patella before and after correction by inlay bone graft. The three photographs are of the same case. In Fig. 91 the outline of the graft is seen in relief in the anteroposterior view. In Fig. 92 the graft is seen in profile while behind it and between the patellar fragments abundant osteogenesis is taking place. (Albee.)

of the bone when in the position of rest, no harmful angulation at the site of the fracture will occur. By the position of rest we mean the position occupied when no forces are acting on the fragment other than those produced by the muscles attached to it. It has been found that very little external force (*i. e.*, acting from without) is sufficient to

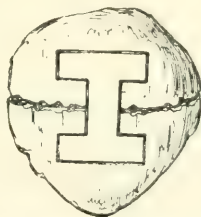


FIG. 93.—A type of the inlay graft used by Dr. Albee for the repair of fractures of the patella. (Albee.)

materially influence this position. Consequently, if a slight restraining external force be provided, considerable latitude of motion of the joint of which the fragment forms a part may take place without changing the position of the fragment. The confining force provided by the stretched muscles when traction is applied is usually sufficient to furnish the slight external force necessary to prevent motion of the fragments

of the bone, and therefore traction in the proper direction may be expected to permit of considerable latitude of motion in the contiguous joints of the involved bone without changing the relative position of the fragment. Traction also overcomes the tendency to overlapping and shortening.

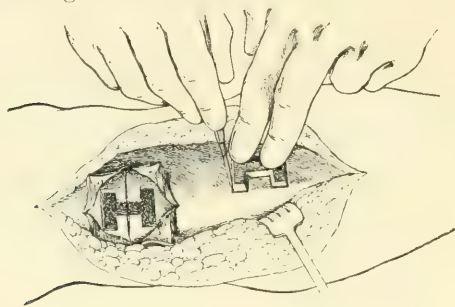


FIG. 97



FIG. 96

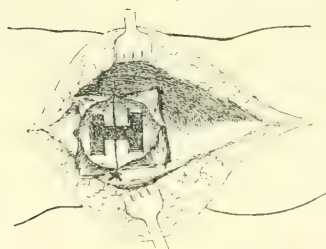


FIG. 95

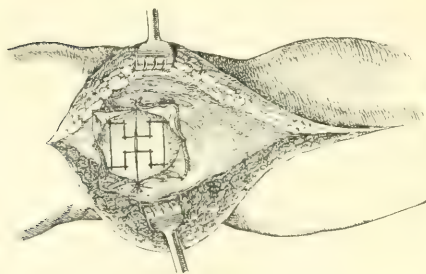


FIG. 94

FIG. 94.—An outline of the bone to be removed, about $1\frac{1}{4}$ inches, has been made on the anterior surface of the patella with the scalpel. With the writer's small motor saw cuts have been made to a depth of $\frac{1}{4}$ inch along the outlines thus made. (Albee.)

FIG. 95.—The fracture surfaces of the fragments have been tilted forward and with small motor saw and narrow thin osteotome the bone within the previously made saw cuts has been removed to a depth of $\frac{1}{4}$ inch from the anterior patellar surface. (Albee.)

FIG. 96.—Melted paraffin has been poured into the mould in the patella. After hardening the model is pried out of its bed with a narrow thin osteotome. (Albee.)

FIG. 97.—The wax model of the gutter in the patella is laid upon the antero-internal surface of the upper portion of the tibia and the graft outlined in the periosteum. (Albee.)

The problem, then, is to maintain traction in the proper direction. If the direction of traction departs too far from that of the axis of the proximal fragment, when in the position of rest, angulation will result at the fracture. Fixation, unless it be complete and the joints on both

sides of the fracture immobilized, will not overcome this danger; for the fixation of one side only increases the possibilities of angulation. On the other hand, if there be freedom of play on both sides, so that the parts on one side are able to follow any motion of those on the other, the danger

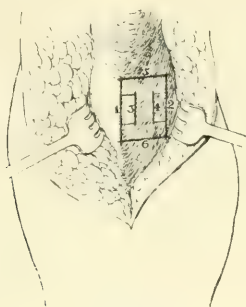


FIG. 98

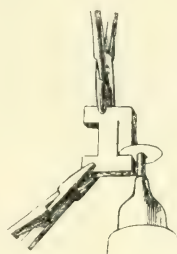


FIG. 99

FIG. 98.—The material for the inlay is removed from the tibia *en bloc*, by cutting with the small motor saw along the outlines previously made with the wax model. The cuts should be made in the manner shown in this figure and in sequence as indicated by the small numbers, 1, 2, 3, 4, 5 and 6. The block of bone is then lifted from its bed with a narrow thin osteotome. (Albee.)

FIG. 99.—After its removal the graft material is held with two pairs of hemostats, while the two longitudinal cuts are connected by cross cutting with the small motor saw and the two intervening portions of the bone are removed. (Albee.)

is eliminated. This freedom of play is accomplished by suspension, and by removing the point from which traction is made to the farthest distance possible from the site of the fracture. Moreover, traction should be made, if possible, on the distal fragment itself and not through the joints distal to the fracture which would immobilize them."

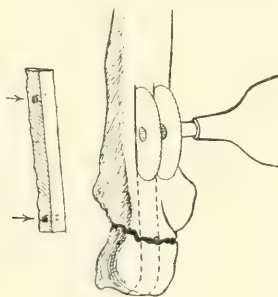


FIG. 100

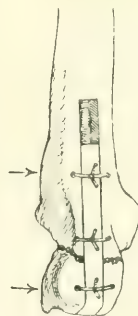


FIG. 101

FIG. 100.—Technic of sliding inlay graft for fracture of the olecranon process. Arrows indicate drill holes in graft. (Albee.)

FIG. 101.—The inlay graft is held firmly in place with kangaroo tendon. (Albee.)

These principles of treatment of fractures by combined traction and suspension are among the most important contributions to surgery that

has developed from our war experience. This method of treatment affords freedom of motion not only to the joints but also to the patient

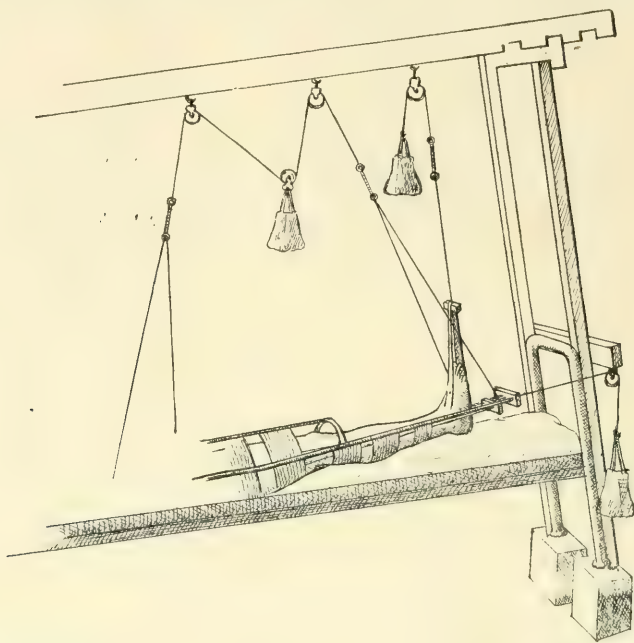


FIG. 102.—Suspension and extension for fractures of lower extremity. (Lee.)

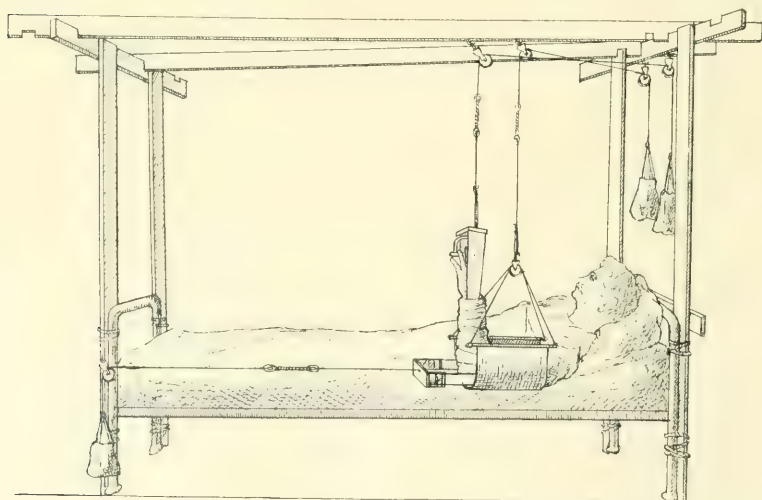


FIG. 103.—Suspension and extension for fractures of upper extremity. (Lee.)

in bed. The vital functions are conserved as well as those of the muscles and the joints.

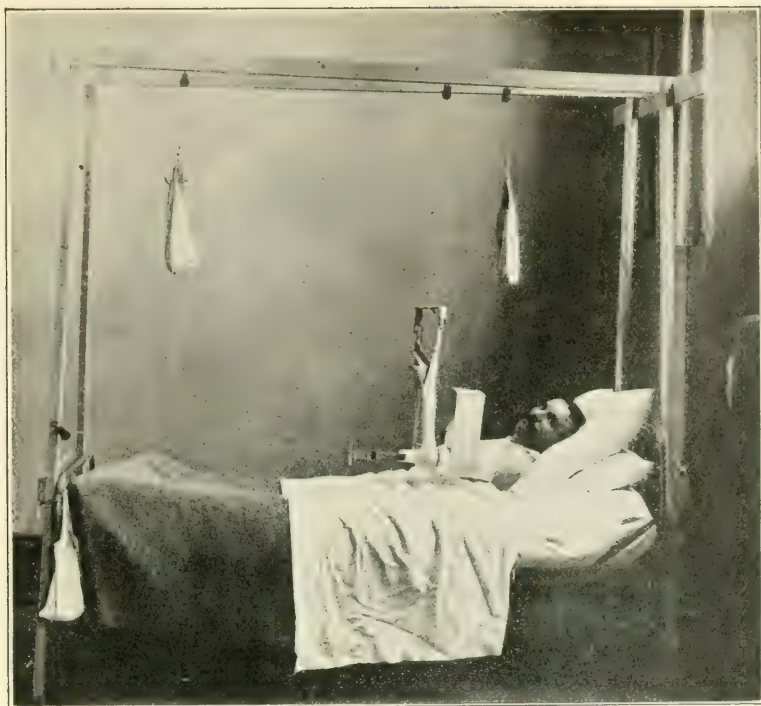


FIG. 104



FIGS. 104 and 105.—Patient able to change position without disturbing the alignment or degree of extension. (Lee.)

Blake and Bulkley¹⁴⁶ report in detail (1) the various parts of the apparatus and (2) the method by which each fracture, according to site, was treated.

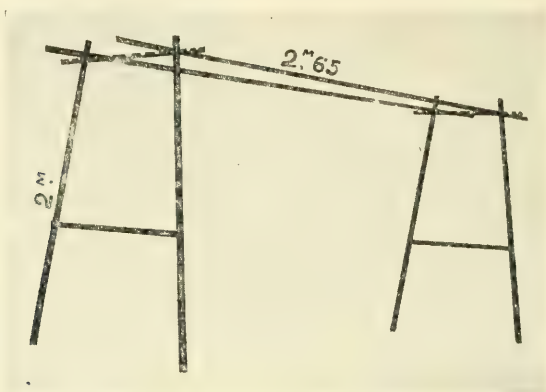


FIG. 106.—Illustrates the general arrangement of the frame not placed on the beds. The longitudinal bars can be shifted laterally to any of the notches in the upper transverse bar shown more clearly in Fig. 107. (Blake and Bulkley.)

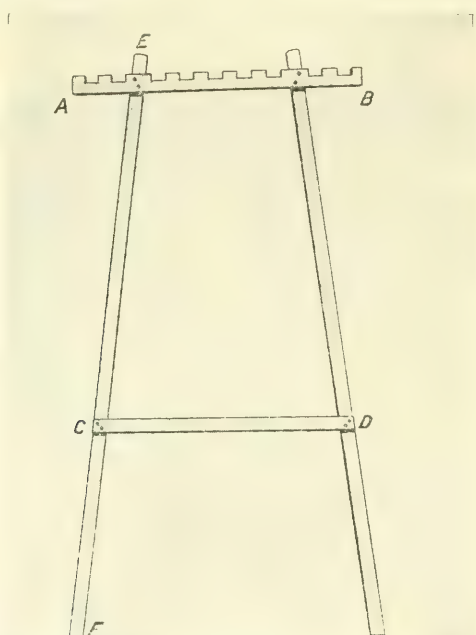


FIG. 107.—To show the details of construction of each end frame. The center notch on the upper transverse bar is seldom used and tends to weaken the apparatus. It is better not cut. Each vertical measures 2 meters. The length of the transverse bars depends on the width of bed used. For the Service de Santé bed the upper bar measures 1 meter and the lower transverse bar 75 cm. (Blake and Bulkley.)

¹⁴⁶ Surgery, Gynecology and Obstetrics, March, 1918, No. 3, vol. xxvi.

THE SUSPENSION TREATMENT OF FRACTURES BY THE HODGEN WIRE CRADLE EXTENSION SPLINT. Nifong,¹⁴⁷ a former assistant of Hodgen,

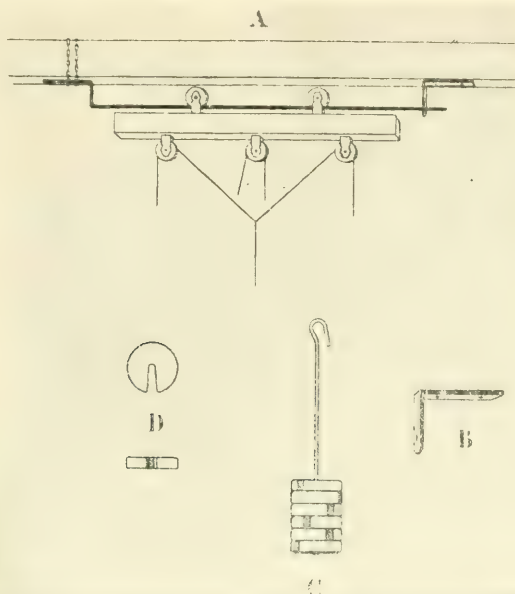


FIG. 108.—To show the arrangement of the trolley. In A can be seen the iron bar serving as a track and right angled at one end while the other end passed through a small piece of iron (B) screwed to a longitudinal bar. The wooden block with 2 pulleys above and 3 below hangs from this bar. C and D show the lead weights used each weighing $\frac{1}{2}$ kilo. (Blake and Bulkley.)

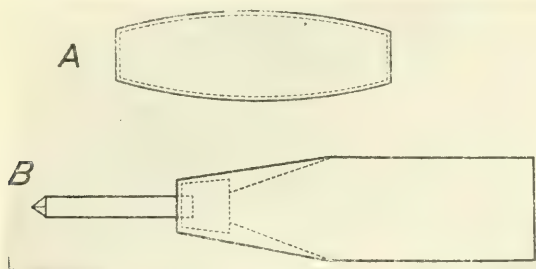


FIG. 109.—A shows the shape of the bands used to support the limb in a Hodgen's or Beak's splint or in a forearm cradle. They are made of two layers of unbleached muslin and in two sizes; the smaller measures 40 by 12 cm. and the larger 60 by 20 cm. With wet dressings, bands of similar sizes, but made of double-faced rubberized linen, can be used. B shows the bands used with slue for traction. They are made of canton flannel in a small size for the forearm and the sole of the foot and a large size for the leg. They measure without the tape 25 by 8 cm. and 40 by 15 cm. respectively. (Blake and Bulkley.)

outlines the mechanical and anatomical principles of the Hodgen splint. The same principles of suspension, mobility of the joints at either

¹⁴⁷ Journal of the American Medical Association, 1918, xlix, 956.

extremity of the femur and fixation at the site of the fracture by the tension of the surrounding soft tissues when treating fractures of the femur have been outlined by Blake.¹⁴⁸

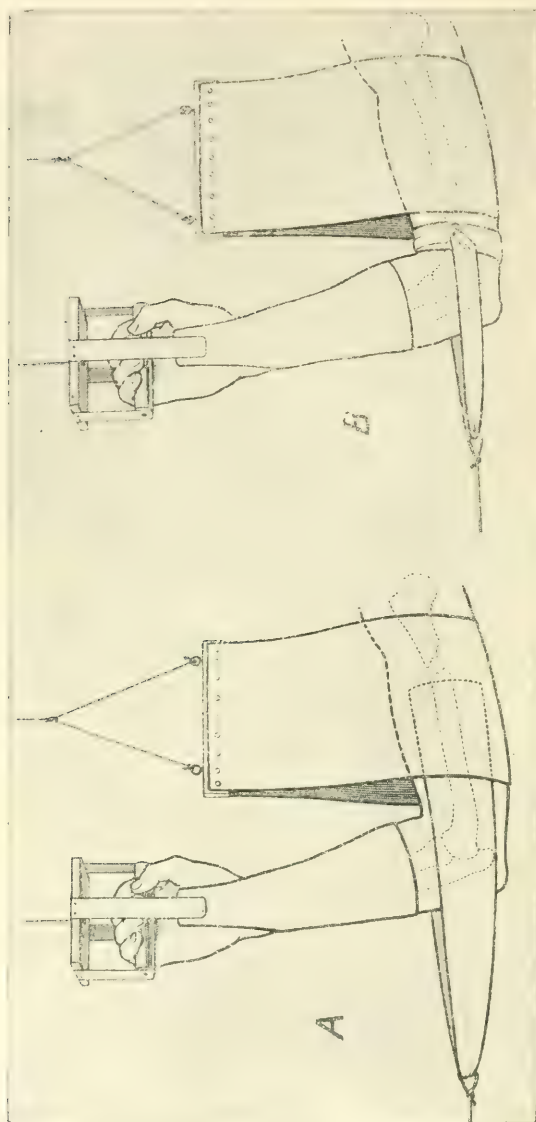


FIG. 110.—Both figures illustrate the general method of suspension and extension in fractures of the humerus. *A* illustrates a high fracture in which traction by glued bands can be obtained. The drawing is incorrect in that no wooden spreader separates the bands. The arrangement of suspensions of the forearm and direct suspension of the humerus are shown. *B* represents a lower fracture where glued bands cannot be employed. Here the Hennequin band is used. The spreader in this drawing is also lacking. It will be noted that the axis of the humeral shaft and the axis of traction are the same and that this is accomplished by the safety-pin holding the band on each lateral aspect of the arm. The detail of the hand spreader can be better seen in Fig. 111. (Blake and Bulkley.)

In contradistinction to the Thomas splint, in which the extension and counterextension are transmitted by means of rope and pulley, through longitudinal bands to the distal fragment, the Hodgen splint provides extension by the inclination of the suspending cord. Counter-extension

¹⁴⁸ *Annals of Surgery*, No. 5, lxi, 458.

is obtained through gravity by raising the foot of the bed. Though Nifong feels that nearly all of the changes of the Hodgen splints have marred, rather than improved it, various modifications of it were



FIG. 111.—Suspension of the forearm in a compound wound of the elbow-joint. The arrangement of the hand spreader (see text) and the lack of support of the upper arm are to be particularly noted. (Blake and Bulkley.)

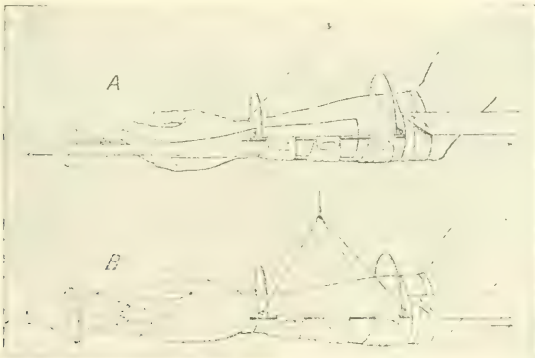


FIG. 112.—The illustration shows the cradle used in fractures of the forearm, the bands supporting the forearm in the cradle, traction either by glued bands (A) or by a glued glove (B). Countertraction by a Hennequin band is also shown. (Blake and Bulkley.)

extensively used in the base hospitals. The principle of skeletal traction upon the distal fragment can be applied to the Hodgen splint as readily as to the Thomas. In most cases the absence of the ring is a distinct advantage.

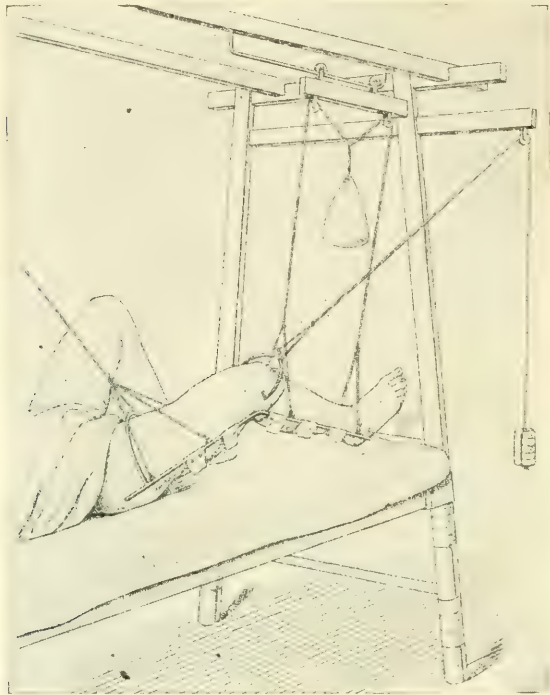


FIG. 113.—Showing the arrangement for a fracture of the upper third of the femur. A Steinman nail has in this case been used. Note the flexion at the knee, the abduction and external rotation. The arrangement for the control of foot-drop has not been figured. (Blake and Bulkley.)

OPEN FRACTURES OF THE LONG BONES. The consistent results obtained by military surgeons in converting open wounds of the soft tissues into closed ones gave them the necessary confidence, during the summer of 1916, to attempt to transform open or compound fractures into closed or simple fractures by the same surgical procedures. Carrel was among the first to attempt this, performing secondary suture after a preliminary progressive chemical sterilization with Dakin's solution. Later, it was found that primary suture could be successfully practised in a certain proportion of cases. But the increased gravity of such wounds always required the most skilled and experienced surgery, and the proportion of successes was never as high as that obtained with soft tissues. However, the demonstration of this possibility of converting compound fractures into simple fractures by an operative procedure is another valuable contribution to the traumatic surgery of civil life.

Depage¹⁴⁹ states that "Immediate suture is attempted only in very exceptional regions in which there is a minimum of soft tissue, as the humerus and forearm. It was never a practice employed in the course

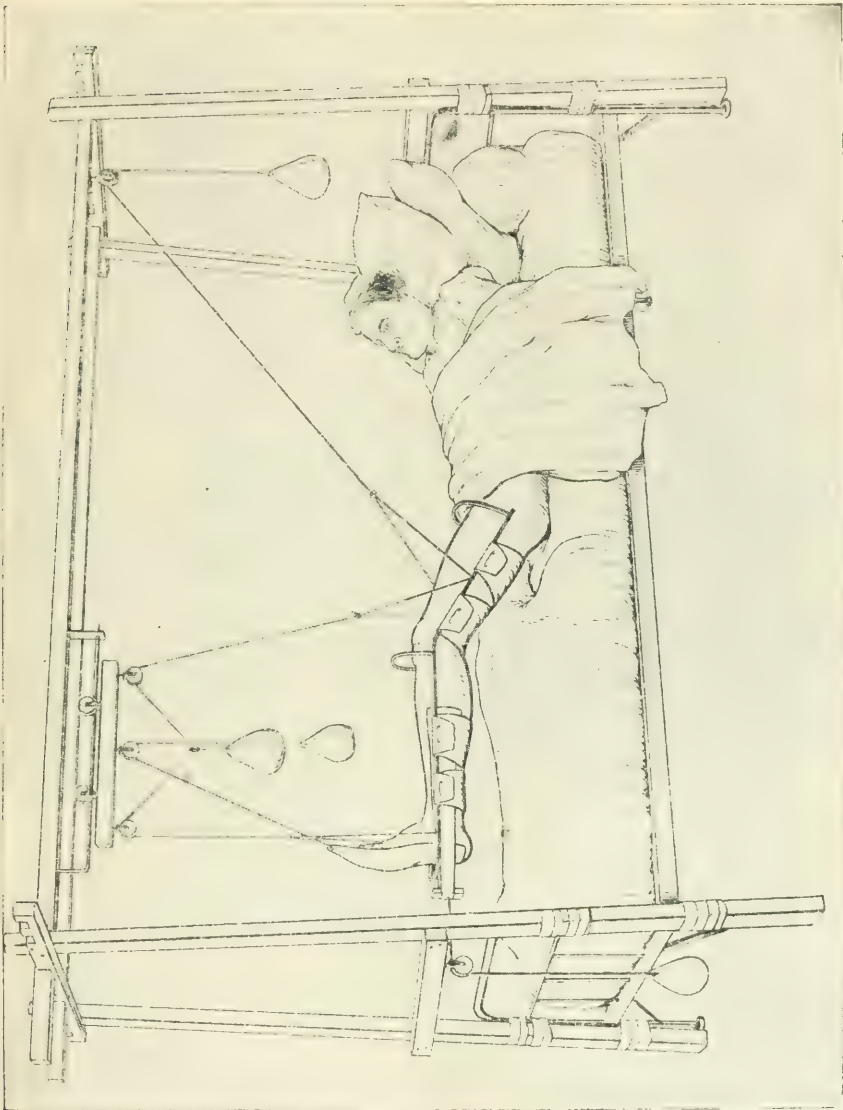


FIG. 114.—Illustrates the method of suspension in fractures of the lower leg. The splint is bent to about 135°. The middle suspension cord is attached too far up the splint, which would balance better if this cord were attached nearer the knee. (Blake and Bulkley.)

of an offensive, and is contra-indicated in wounds of the soft tissues that date back more than eight hours, or that cannot remain under the care of the operating surgeon.

¹⁴⁹ American Surgical Association, June, 1919.

Primary delayed suture, or early secondary suture, is practised when the bacterial content reaches the stage of surgical sterility, namely, an average of one organism in three microscopic fields.

Late secondary suture is the most frequently employed. It may be used as soon as the Carrel treatment has produced the clinical sterilization of the wound, from fifteen days to a month. When the infection has been due to streptococci, secondary suture must be postponed until the wound is free of these organisms, even though it be for several months.

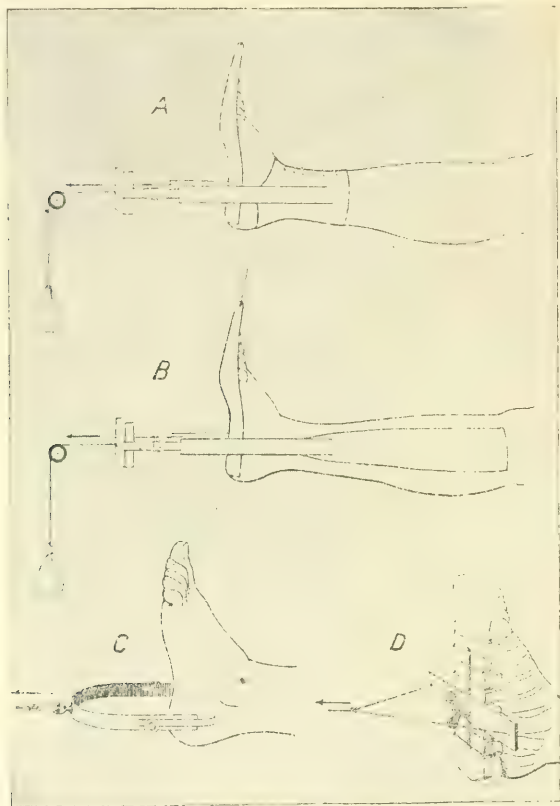


FIG. 115.—To illustrate four methods of obtaining traction in fractures of the leg. (Blake and Bulkley.)

COMPOUND FRACTURE OF THE FEMUR. Bulkley and Sinclair¹⁵⁰ report a critical analysis of 131 cases of fracture of the femur treated in the service of Colonel Blake at the American Red Cross Hospital No. 2, Paris, and offer the following conclusions:

1. The chief danger lies in infection, gas gangrene in the early weeks and streptococcus in the later weeks. These forms of infection can be combated with best results by early, adequate and radical surgery.

¹⁵⁰ *Annals of Surgery*, May, 1919, No. 5, vol. lxix.

2. Bullet fractures are as a matter of fact as dangerous as those caused by shell fragments. The occasional bullet wound may be observed without operation, the shell wound never.

3. Those fractures splitting into the hip or knee-joints are infinitely more dangerous than those involving only the intermediate portions of the bone. Those involving the hip should probably always indicate amputation and then disarticulation. The majority of those involving the knee will necessitate resection or amputations.

4. The primary operative procedure should be radical to the point of apparent brutality. We have never seen too large an incision. We have seen many pitifully inadequate ones.

5. Amputation should be done oftener and earlier. Too many attempts are made, with results disastrous to life, to save worthless limbs.

6. The ideal form of traction is skeletal, and this form of traction is practically without danger. Femoral traction is superior to tibial traction. Less than half the weight is required in skeletal traction than in the Buck's type with glued bands, the control is absolute, there is no uncertainty of the amount of traction lost on skin and deep fascia, and, in our experience, the patient is more comfortable. Where possible, this traction should be applied to the lower portion of the femur itself. At times, however, it is necessary to apply it through the ligaments of the knee-joint, using the tibia for this purpose. The location of the wound, of course, determines this. The danger of infection from wounds situated low in the thigh makes the use of the tibia necessary.

Bulkley and Sinclair's rule has been to apply a heavy weight during the first three days and then diminish it gradually, a practice which is a direct contradiction to the older teaching which applied traction lightly at first with gradually increasing weight. "We are convinced," they say, "that shortening due to muscular contraction is more easily, quickly and permanently controlled in this way than by the older method." That the greatest traction is needed in the early part of the treatment of shortening due to muscular contraction needs no discussion, but the practice of gradually applying the weight has been made necessary because the adhesive or glued bands of the Buck type of extension will not permit much strain until after they become adherent to the skin, a period of at least twenty-four to thirty-six hours. The possibility, offered by skeletal traction, of applying the necessary force to overcome deformity before muscular spasm develops, or to counteract muscular contraction and permit of normal apposition of the fragments, is of inestimable value. Further, in applying traction directly to the bone, instead of through the joint, relaxation of the ligaments of the joint can be avoided.

The tongs can be applied with local anesthesia, but they prefer a general anesthetic, using inhalations of ethyl chloride. The point of application should be in each side of the femur about one finger's breadth in front of the hamstring tendon and should meet the femur just at the point of greatest prominence of each condyle. They discarded the use of the Steinman pins for the caliper.

Thuffier contributed to the Inter-Allied Surgical Conference, in 1917, the result of his studies of the *END-RESULTS OF THE TREATMENT OF WAR FRACTURES OF THE SHAFT OF THE FEMUR*. This report was based upon a group of 16,392 cases. It must be remembered, however, that these wounds were all received and had their primary treatment prior to December, 1916, long before the radical surgical treatment of immediate operation, mechanical or chemical sterilization and earliest possible closure of the wound, was practised. But the studies are of definite value as a basis for comparison with the results obtained in the later periods of the war.

Location. The worst results were obtained in fractures of the lower fourth and upper fourth of the bone.

Loss of Function. 22.42 per cent. resulted in an absolute functional loss of the extremity.

Causes of these poor results were: (1) *Infection*, with the resulting chronic osteomyelitis; (2) *shortening* was constant in every case and varied from 1 to 20 cm. A shortening exceeding 5 cm. was found to insure marked disability; (3) *outward rotation* was present in 70 per cent. of the cases; (4) the typical *angulation* of fracture in this position, forward and outward.

He emphasizes the fact that a fracture of the femur once infected is never free from recurring attacks of osteomyelitis. A simple traumatism or overuse may initiate acute osteomyelitis and suppuration. He has seen an operation performed upon a suppurating osteomyelitis in a soldier who had been wounded in the war of 1870, the operation being twenty-five years after the injury was received.

Pseudarthrosis is fortunately less frequent in fractures of the femur than in the forearm or arm. In the orthopedic service at Paris, he found 10 pseudo-arthritis of the femur, while there were 500 of the arm and 400 of the leg. The most frequent cause of non-union is probably infection of the bone, and its treatment should consist in the resection of the bony ends and the fixation of them by autogenous bone grafts or plates.

Ankylosis or stiffness of the hip, knee and ankle was extremely common and was found in 76.2 per cent. of all cases in this early group. These frequent ankyloses in the joints not affected by traumatism were the result of their immobilization during the treatment of the fracture. Blake was the first of the American surgeons to attempt to prevent these disabling results, and his method of suspension and extension was devised toward this end. Colonel Hutchinson, in 1916, made the remark, that in his group of 2000 convalescent patients in the American Ambulance, the stiff and ankylosed joints were to him his greatest source of regret.

An editorial comment in the *Annals of Surgery*, January, 1919, No. 1, vol. lxi, says: "The primary cause of defective results in the treatment of fractures of the thigh sustained during the first three years of the war is recognized as infection of the wound and the osseous focus, for the non-infected fractures gave results equal to those in peace times. The infection produces secondary osteomyelitis, the duration of which is uncertain and necessitates a prolonged treatment. The long duration

of the treatment, the difficulty in making the dressing and of maintaining at the same time the exact coaptation, explains the frequency of the alteration in the axis of the limb, the angular deformity, the deposits of deforming callus, the musculoperiosteal adhesions and the vicious cicatrices, all of which result in loss of function."

BONE NECROSIS FOLLOWING COMPOUND FRACTURES. That a distinction should be made between the local circumscribed inflammation of bone produced by the infection in compound fractures, and the massive inflammation following infection of hematogenous origin, is generally recognized. The term osteomyelitis, which is applied to the latter, should not be used for the local necrosis in the former condition. Infection of bone in compound fractures, if it is not mechanically removed, is always followed by more or less death of the bony tissue.

Taylor and Davies,¹⁵¹ in an examination of the sequestra from bone infections following compound fractures, found that bacteria were seen, usually in nests within the canals or cell spaces within the substance of 90 per cent. of the sequestra examined histologically. It was also observed that more organisms were recovered from the sequestra than from the soft tissues. They explain the persistence of bacteria within the sequestra by the mechanical protection afforded by the dense bone structure against body fluids, and remark that leukocytes were rarely seen within the specimens of sequestra examined.

They believe the persistent sinuses which usually follow the bone lesions of this character are often due to the presence of organisms within the dead bone rather than to the organisms in the soft tissues, and it by no means follows that the complete closing of a sinus indicates that the bone has become sterile. Growths were obtained from sequestra removed from cases in which the sinus had been closed for two weeks or longer. "Flares," a term applied to the rise of temperature within twenty-four hours after sequestrectomy, may probably be regarded as an evidence of a temporary acceleration of the growth of the organism. This is entirely in accord with our clinical experience in the past with the persistent sinuses following so-called chronic osteomyelitis. When these persistent sinuses followed a massive infection of the bone or true osteomyelitis, surgical experience had shown that any extensive operative procedure upon the new-formed bone engendered a flare of such severity that it might seriously endanger the life of the patient. For this reason the dead bone was permitted to separate in the form of a sequestrum and then to extrude itself or be surgically removed with the least possible disturbance to the surrounding bone. This danger of radical surgical intervention in the chronic sinuses following diffuse osteomyelitis was accepted as applying also to the lesions following a localized osteomyelitis and, therefore, in the early years of the war the localized necrosis following compound fractures was treated by a conservative expectant method. That the danger of radical operation upon the localized necrosis was practically *nil* was appreciated by Leriche as early as 1917, and gradually, as these chronic bone sinuses began to

¹⁵¹ Medical Bulletin, March, 1918, No. 5, i, 398.

accumulate, the necessity for the radical mechanical removal of the infected scar tissues of the fistulous tract and all of the infected necrotic bone was demonstrated. That, however, this knowledge was slow in being disseminated was shown by the fact that among the wounded returned to this country from the A. E. F. there were more than 5000 cases of unhealed bone fistula in the U. S. Army hospitals in January, 1918.

Surgeons are indebted to Chutro for the development of a technic for the treatment of these bone necroses following compound fracture that has given results to which we have been unaccustomed in the civil surgery of the past.

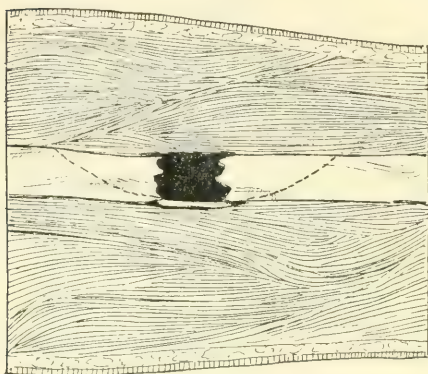


FIG. 116.—Transverse fracture; dotted line showing bone to be moved. (Dehelly and Loewy.)

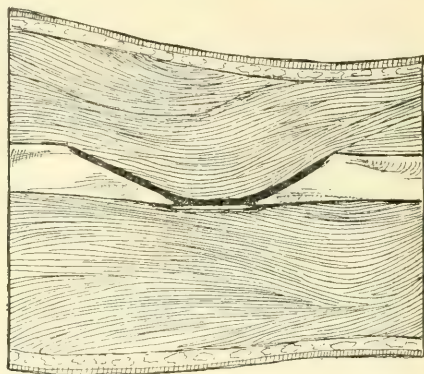


FIG. 117.—Same as Fig. 116, after operation. (Dehelly and Loewy.)

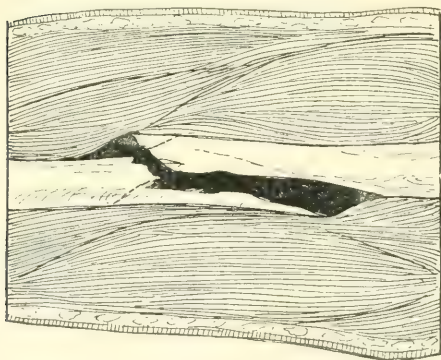


FIG. 118.—Long bevelled fracture of femur; dotted lines indicating projecting fragments of bone to be removed. (Dehelly and Loewy.)

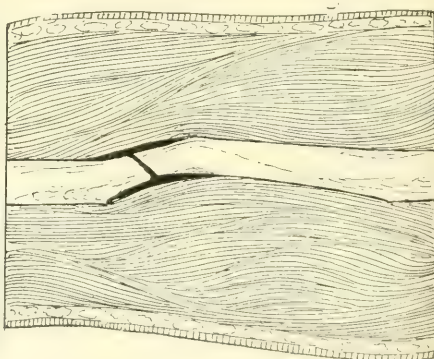


FIG. 119.—Same as Fig. 118, after operation; the soft parts filling the cavities. (Dehelly and Loewy.)

EFFACEMENT OF BONE CAVITIES IN THE TREATMENT OF COMPOUND FRACTURES. Dehelly and Loewy¹⁵² call attention to the necessity, when

¹⁵² *Annals of Surgery*, April, 1919, No. 4, lxix, 367.

operating upon compound fractures, of obliterating all dead spaces both of the bone and the soft tissues. They feel that the complete surgical procedure as shown in the accompanying illustrations, should be supplemented by the external application of pressure on the soft parts of the limb by such an apparatus as that of Henequin. "And from this point of view, such immobilizing apparatus as that of Thomas or the Blake splint have the great drawback of not permitting the compression." The principle is an obvious one but the application of

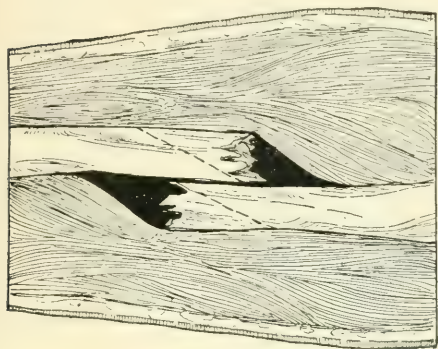


FIG. 120.—Overriding fracture of the femur, showing the proper operation. (Dehelly and Loewy.)

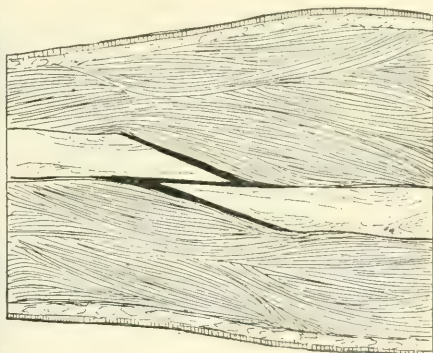


FIG. 121.—Same as Fig. 120, after operation. (Dehelly and Loewy.)

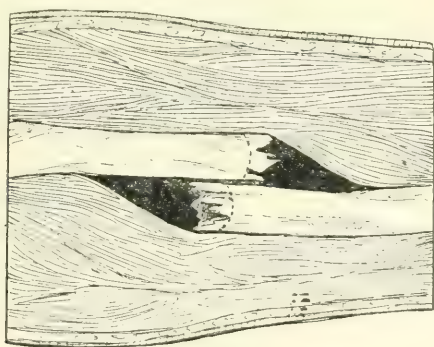


FIG. 122.—Fracture of femur with overriding fragments. (Dehelly and Loewy.)

constricting splints is not without danger, for, if improperly applied and not carefully observed, the pressure exerted will create circulatory disturbances in the enclosed tissues and superficial pressure sores and various degrees of gangrene may result. This was demonstrated in a personal experience during the early part of the war when the French and English were using encircling plaster casts as dressings for their compound fractures. Blake calls attention to the atrophy and circulatory disturbances, resulting from such constricting apparatus.

No one, however, at the present time would be willing to take issue

with them as to the necessity for the effacement of the cavities in bone which are the result of chronic infection. All cavities in body tissues heal in the same way, first filling with granulation tissue which gradually changes into connective tissue of the fibrous character. In the soft tissues, this fibrous tissue gradually contracts and draws with it the non-resisting walls until finally the cavity is obliterated. Cavities in bone also, if they become sterile, fill with granulation tissue and such granulation tissue will be gradually transformed into scar tissue and



FIG. 123.—Compound comminuted fracture of the upper third of the tibia, with loss of bone tissue of the posterior aspect, creating a dead space. (Dehelly and Loewy.)

this scar tissue will contract, but the walls of the bony cavity are resistant and cannot be drawn inward as in soft tissues. Therefore, the scar tissue contracts from the center outward toward the bony wall, and, as time progresses, a central cavity will form in the scar tissue which will become larger and larger. The end-result will be the bony walls, unchanged in position, and lined with a layer of fibrous scar tissue of varying thickness. Such cavities frequently become sufficiently sterile to allow them to close, but, after months and years, a slight blow, a general infection, or lowered body resistance will "light up" the old

process and a sinus will form. These cavities must not only be radically operated upon and all dead tissue and infection removed mechanically, but they must be operated on in such a way that the bony cavities will become obliterated. The principle, which was first suggested by Broca, is to remove subperiosteally the necrosed and infected tissue, in such a way as to take away more than one-half of the circumference of the bone in order to eliminate any overhanging bony wall. If sufficient strength will be provided, it is best to leave a flat strip of bone bridging



FIG. 124.—Removal of the upper and posterior aspect of the lower fragment of the tibia, showing the sloping cavity which can be filled in by soft parts. (Dehelly and Loewy.)

the remaining space. This excision should be done so as to leave the remaining wound like a shallow dish. Usually, the anterior or posterior portions of the walls are removed in order to permit the filling of the cavity by the collapse of the adjacent soft tissues. If, however, the involved bone is on a lateral surface, the removal is made in a vertical plane permitting of a lateral collapse of the soft tissues into the cavity. Finally, after the bony cavity has become surgically sterile, efforts can be made to fill it with pedunculated muscle flaps swung from the adjacent muscular tissues. The object is to remove subperiosteally all but

one rigid wall of the cavity and to permit of the filling of the space by the collapse or transplantation of adjacent muscular tissues.

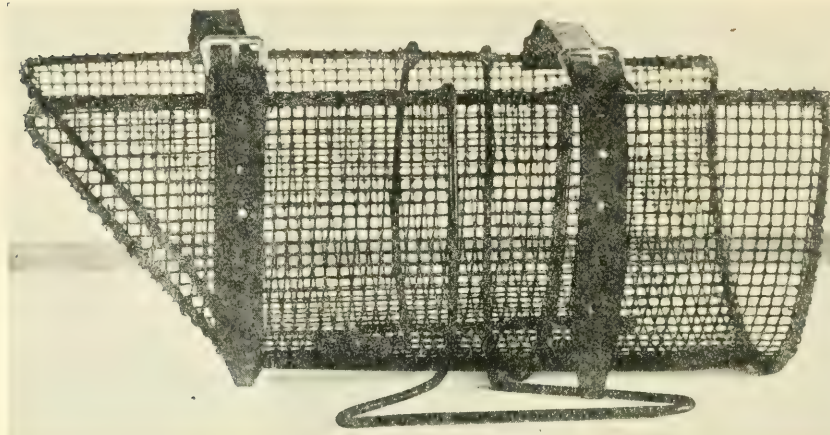


FIG. 125.—Hennequin apparatus for treatment of fractures of femur. (Dehelly and Loewy.)

TREATMENT OF BONE FISTULÆ. Chaliér¹⁵³ reports 32 cases of fistulæ of bone in which he obtained recoveries after excising the whole fistula, the surrounding cicatricial tissue of the soft part and all the diseased

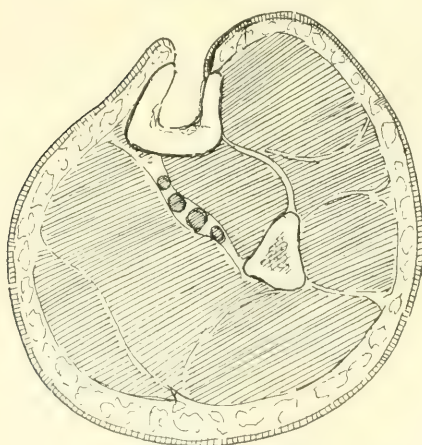


FIG. 126.—Usual insufficient operation on tibia, the lateral walls preventing apposition of soft parts. (Dehelly and Loewy.)

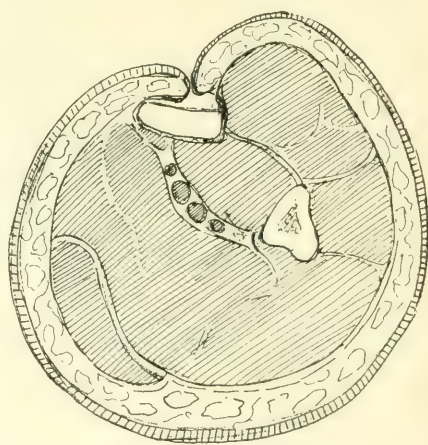


FIG. 127.—Walls removed, allowing soft parts to approximate. (Dehelly and Loewy.)

bone, and then closing the wound by primary suture. In only one case was there recurrence of a fistula.

¹⁵³ Lyon chir., 1918-1919, xv, 732.

Thompson¹⁵⁴ has published a careful description of anatomical methods of approaching the long bones of the extremities. If it had been possible for every military surgeon to have had this knowledge, or at least to have had available these plates, a large proportion of the reconstructive surgery, now before us in the returned soldiers, could have been avoided. He remarks upon the good abdominal surgery one sees when visiting clinics but, with few exceptions, the work done on the arms and legs is not of the highest order.

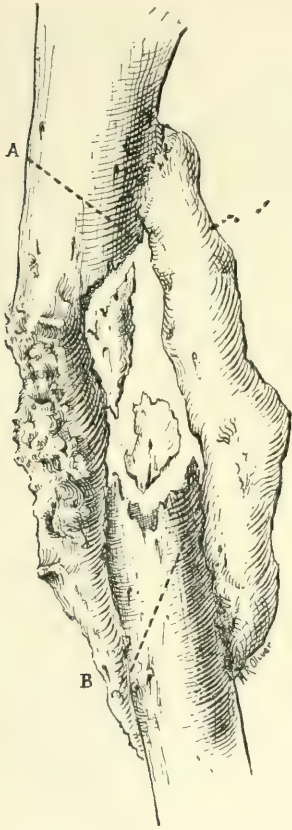


FIG. 128.—Fracture of femur, middle third, united by circular callus, showing cavity with two sequestra. Chronic fistula. A, B, extent of bone tissue removed. (Dehelly and Loewy.)

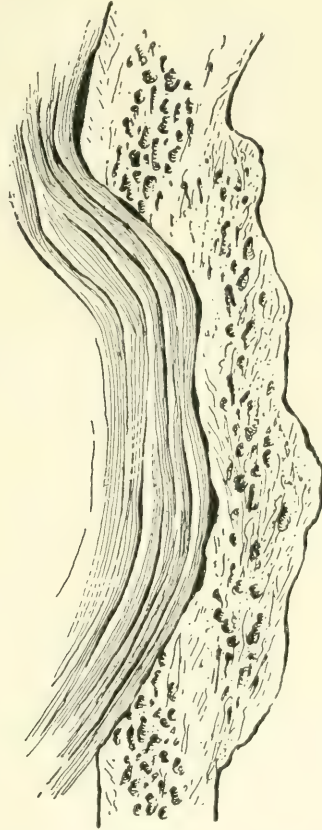


FIG. 129.—Schematic longitudinal section of the same with bone tissue removed and soft parts suppressing the cavity. Rapid healing. (Dehelly and Loewy.)

The fractures, recent and old, and the chronic osteomyelitis that have been added to our surgical problems will require the anatomical knowledge Thompson presents. "In exposing long bones, the following principles must be observed:

¹⁵⁴ *Annals of Surgery*, September, 1918, No. 5, lxxviii, 309.

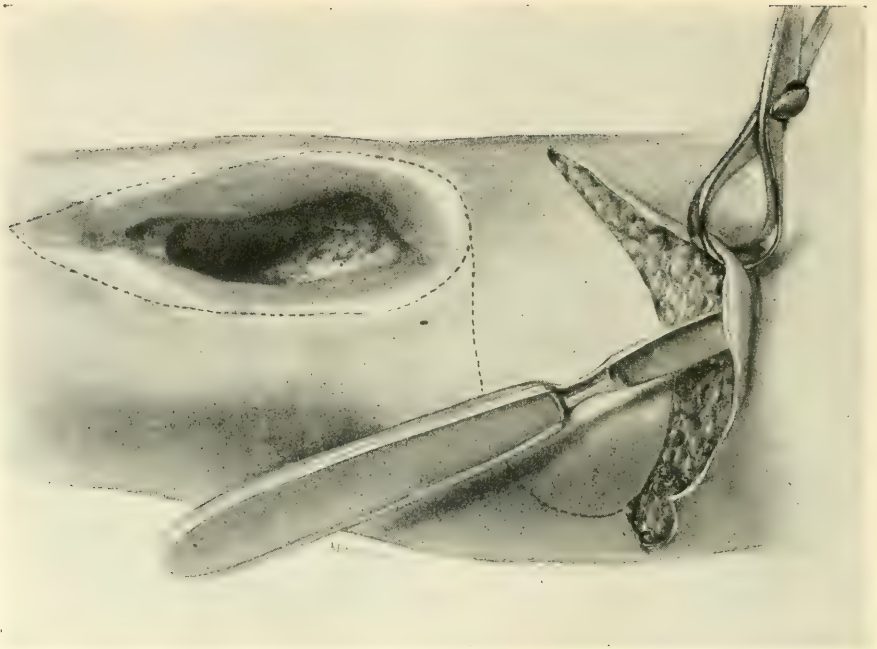


FIG. 130.—Skin flap with adipose tissue. The fat is removed subcutaneously by undermining the surrounding skin. Dotted line shows excision of scar and incision for skin flap. (Dehelly and Loewy.)

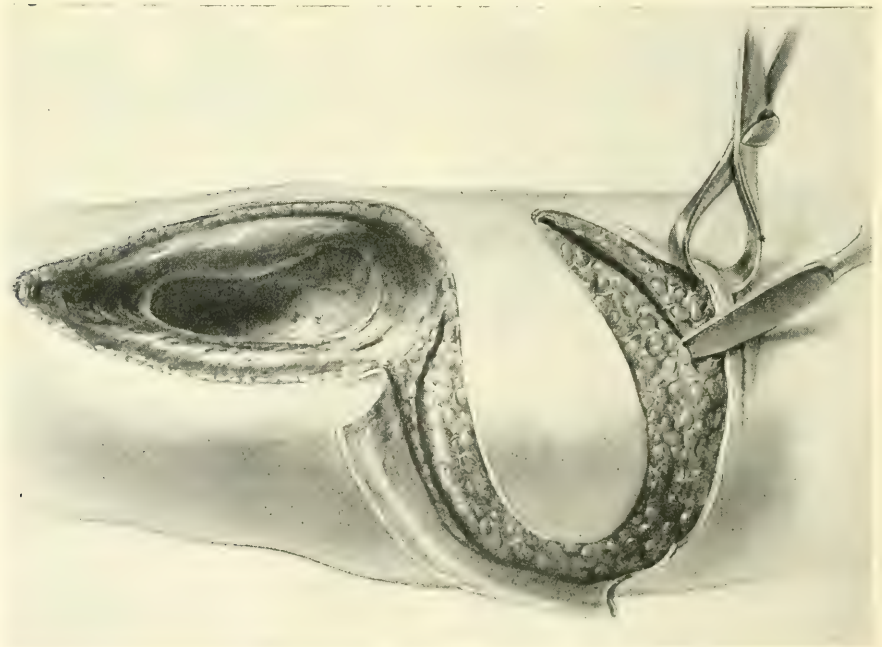


FIG. 131.—After undermining skin, fat flap is made by an incision to the aponeurosis, at some distance from the skin edge of flaps. (Dehelly and Loewy.)

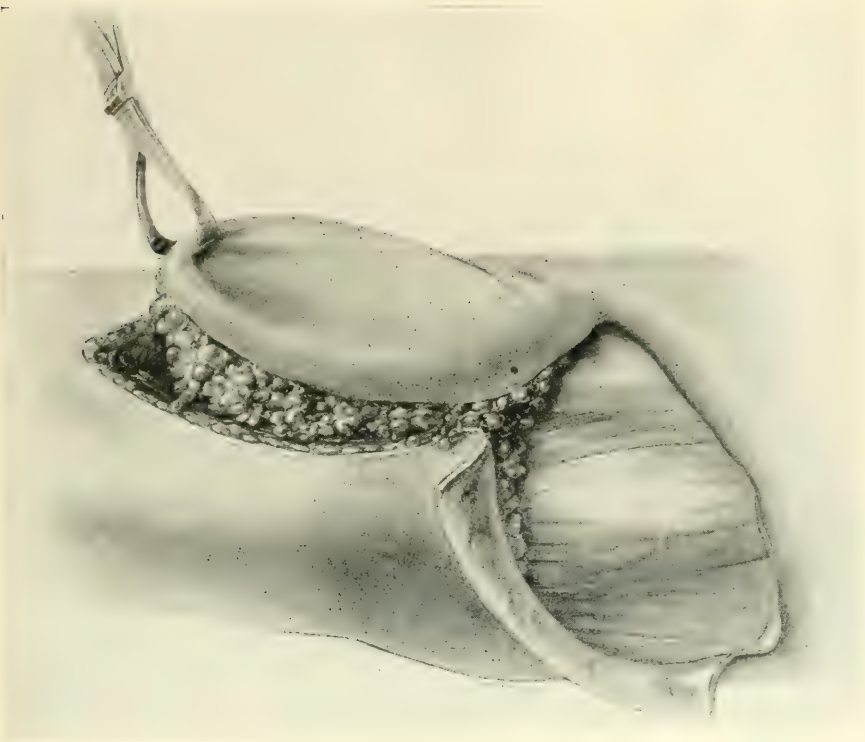


FIG. 132.—Flap turned, the fat filling the cavity. (Dehelly and Loewy.)

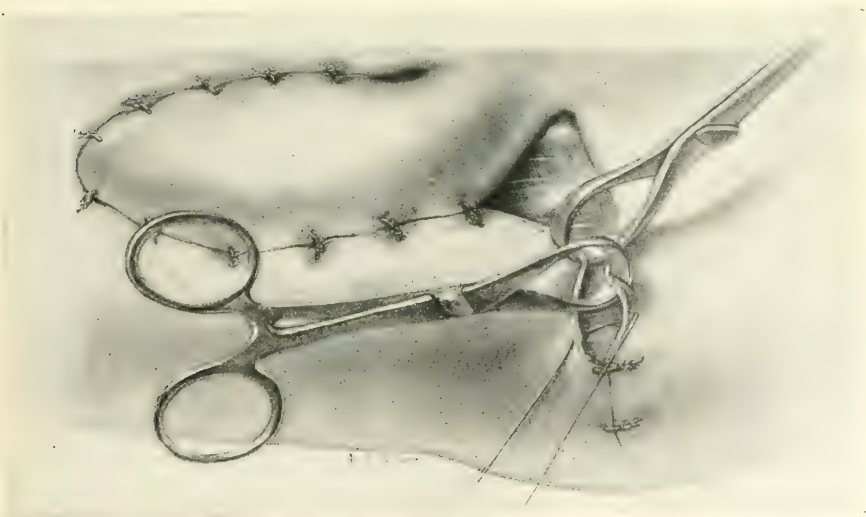


FIG. 133.—Closure with suture, leaving a small area uncovered, which will heal by granulation or with skin graft. (Dehelly and Loewy.)

1. Easy access to the site of fracture or disease.
2. Preservation of all nerves, both sensory and motor.
3. Prevention of unnecessary injury to muscles.
4. The preservation of the vascular supply."

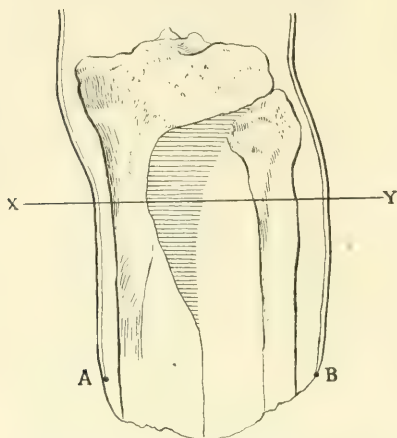


FIG. 134.—Stump of upper third of leg. Chronic fistula connected with a cavity at the outer and posterior aspect of the tibia. *X-Y*, cross-section through cavity; *A-B*, line of incision beyond scar tissue. (Dehelly and Loewy.)

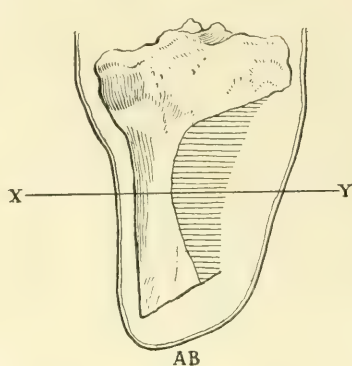


FIG. 135.—Removal of fibula, the soft parts suppressing the cavity. Healing by first intention. *X-Y*, cross-section through site of cavity, fibula removed, cavity suppressed by approximating soft parts; *AB*, line of incision. (Dehelly and Loewy.)

OSTEOMYELITIS.

Acute Osteomyelitis in Children. Alfred C. Wood,¹⁵⁵ defines acute osteomyelitis in children as "an acute inflammatory process affecting chiefly the long bones during childhood and adolescence. It is the most common inflammatory disease of bone as well as the most serious, on account of both local and general consequences, immediate and remote. The flat and irregular bones are rarely affected."

He is of the opinion that the term should be restricted to cases due to primary blood infection of the medullary tissues by virulent pyogenic organisms, and would exclude cases of osteomyelitis secondary to open fractures, designating the latter, according to the etiology, as osteomyelitis following open fracture, post-typhoid osteomyelitis, etc. The disease is usually restricted to definite parts of certain bones and to the period of life when growth is most active. At the diaphysio-epiphyseal junctions, the bones acquire their increase in length and it is from these growing portions of the bones during their period of growth and great physiological activity that there is an unusual supply of blood.

It is claimed that the medullary tissue of bone shares, with the spleen and the liver, the power of destroying microorganisms circulating in the blood-stream, and they have actually been found by numbers of observers in the medullary tissue, after acute infections. Trauma and exposure

¹⁵⁵ Surgical Section, Pennsylvania State Medical Society, 1918.

to cold, devitalizing or lessening the resistance of the tissues, are the usual predisposing factors. The infecting agent in the majority of the cases is the *Staphylococcus pyogenes aureus*. The streptococcus, either alone, or associated with the staphylococcus, is occasionally met with. Because bone cannot expand, to accommodate the inflammatory increase in the volume of blood and cell proliferation, the intramedullary pressure becomes extreme. This tension explains the excruciating pain felt in the early stages of the disease. It is a well-known fact that bacterial activity, when under pressure, is much more virulent in its effects than under any other condition. Hence the rapid coagulation necrosis, venous thromboses, diffuse suppuration, and early death of the bone in whole or in part. The only chance of the bone to escape destruction is through prompt relief, attention by the surgeon, or else by rapid perforation of the cortex by the pus. The process spreads rapidly, following the line of least resistance, which is apt to be along the canal of the bone. Perforation of the cortex of the bone by pus at one or more points usually occurs during the first forty-eight hours, forming a subperiosteal abscess, later the pus breaks through the periosteum, widely infiltrating the cellular tissues. If, in addition, the periosteum is largely or wholly destroyed, total necrosis will result. The epiphyseal cartilages act as a barrier, and the adjacent joint usually escapes unless the epiphyseal line is within the joint capsule, as in the epiphyses of the femoral head. Separation of the epiphysis from the diaphysis occurs between the second and seventh day in from 12 to 15 per cent. of cases. When this occurs, further growth of the bone from this end may be arrested.

The amount of bone lost and the prevention of the many serious possibilities, depend largely upon the promptness of relief of the intramedullary tension, and, when this is accomplished, further spread of the disease will be arrested. The portion of the bone which has been deprived of its nutrition thus gradually becomes separated, forming a sequestrum, the process covering a period of from six weeks to six months. The only treatment after locating the focus is to open the bone at this point at the earliest possible moment. The approach to the bone should be as direct as possible in a position to permit subsequent drainage. Enough bone should be removed to permit adequate drainage.

JOINTS.

Joint Wounds. The evolution in the surgical treatment of joint wounds could have no better reporter than Depage, and his address to the American Surgical Association, June, 1919, contains the story of the experience of most surgeons who served during the whole period of the war. "In general, an articulation kept open becomes infected notwithstanding the most careful daily care. On the other hand, the immobilization to which the limb is usually subjected and, added to this, the constant irrigation of the surfaces by secretions with which they are bathed, serve to determine the presence of adhesions and ankyloses.

During the first period, extending from December 20, 1914, to September 10, 1915, we treated joint wounds by the methods then every-

where in use, drainage of the cavity, renewal of the dressing several times each day, each time irrigating the cavity with antiseptic solutions, such as oxygenated water, formalin water, and carbolated water, etc. The limb was immobilized either by means of a bridged apparatus or by means of a gutter splint. The results were frankly bad." And, with this statement the reviewer can personally agree, for the joint wounds became almost a horror to the American surgeons working at that time.

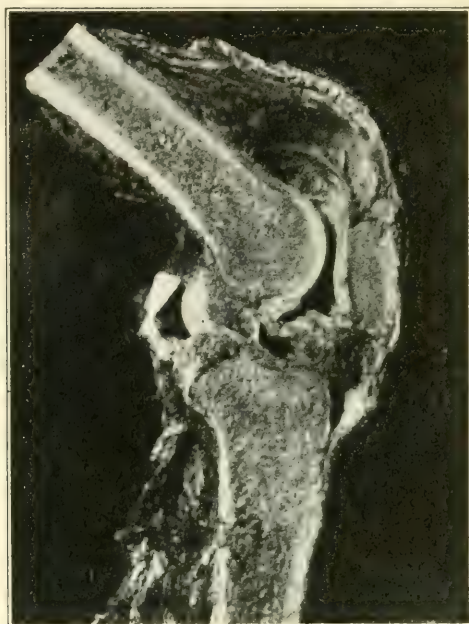


FIG. 136.—Medial section through knee-joint. Note the subcrural pouch divided by irregular septa, communicating with the suprapatellar pouch. The ligamentum mucosum divides the suprapatellar and infrapatellar pouches, and the infrapatellar pad of fat intervenes between the infrapatellar pouches and the bursa beneath the ligamentum mucosum. The posterior pouch has been opened to show its extent and the level of reflection of the synovial membrane posteriorly. (Hughes and Banks.)

"During the second period, extending from December 10, 1915, to July 1, 1916, the method of Carrel, after débridement of the wound, was applied and the results were a distinct improvement over those of the first period but still not very brilliant. Since the month of July, 1916, we have resorted to wide arthrotomies with immediate closure of the joint whenever possible" Their results (which have been entirely corroborated by the experience of American Surgeons of the A. E. F.) show indisputably the superiority of immediate suture after wide arthrotomy over any other method of treatment.

The primary closure of joint wounds, so contrary to our pre-war practice, is consistent with the experience with wounds of the soft tissues. Open joints, like open wounds of all kinds, always become infected. It is now realized that the early closure of joint wounds is made

possible by natural defensive powers which were not appreciated in the past.¹⁵⁶ "The defensive powers possessed by joints against invading organisms appear to be very similar to those possessed by other serous membranes, such as the peritoneum, meninges, pleura and pericardium. The resistance to infection of all such membranes is partly due to the character of the exudate, which is so readily poured out in response to infection, and partly due to the anatomical structure of the membrane itself. The serous exudate is rich in antibodies and in actively phagocytic endothelial cells. In addition, it



FIG. 137.—Section through knee-joint. Note partition formed by the crucial ligament, dividing the posterior pouch completely into two. Note also the septum in the subcrural pouch. The ligamentum mucosum has been removed. (Hughes and Banks.)

contains fibrinogen, which acts, at certain points, as a basis for plastic adhesions of the synovial surfaces. The living membrane of the joint is thus enabled to act in the same way as the peritoneum when it shuts off infected foci by surrounding them with adhesions. While the range of mobility of the synovial membrane is naturally somewhat more restricted than that of the peritoneum, this action of localization of infection is to some extent assisted by the rigid character of the synovial surface, whereby the division of the joint into pouches and loculi is rendered

¹⁵⁶ Hughes and Banks: War Surgery, William Wood & Co., p. 334.

possible. These ridges are readily demonstrated in sections made through the hardened tissues of specimens in which the joint has been distended with formalin under pressure. Three or four of such ridges exist in the subcrural pouch alone and the other pouches of the joint are constructed on similar lines.

The loculation of the synovial membrane makes it possible for one or more pouches to be shut off from the general joint cavity. This condition actually occurs in certain cases of infection following penetrating wounds of joints. Examples of joint pouches which may be shut off in this way are, in the case of the knee-joint, the subcrural and the posterior pouches (the latter by obliteration of the lateral channels formed by the reflection of the synovial membrane off the condyles of the femur). Thus, when infection invades a joint, the whole extent of the joint sur-



FIG. 138.—Dissection to show posterior bursa. (Hughes and Banks.)

face need not become involved, and in many cases the infection remains localized to one or more parts of the cavity. This is possible in a large number of gunshot wounds of joints for in most of these, in the first instance, the infection invades only a small part of the joint, *e. g.*, one or more of the anterior pouches in the case of the knee-joint."

Hughes and Banks¹⁵⁷ outline the following conditions as favoring localization of infection within joints: (1) Perfect immobilization of the joint; (2) reduction of the amount of exudate, if excessive, by aspiration; (3) injection of certain antiseptics, *e. g.*, ether; (4) complete closure of the wound in the joint capsule, so as to prevent continued access of infecting organisms from the outside; (5) fixation of the joint in such a way as to prevent spread of infective fluid by the action of gravity.

¹⁵⁷ Hughes and Banks: *Loc. cit.*



FIG. 139.—Section of knee-joint with patella turned back to show the line of reflection of the synovial membrane from the femoral condyle. This is the route of communication between the anterior and the posterior pouches. (Hughes and Banks.)

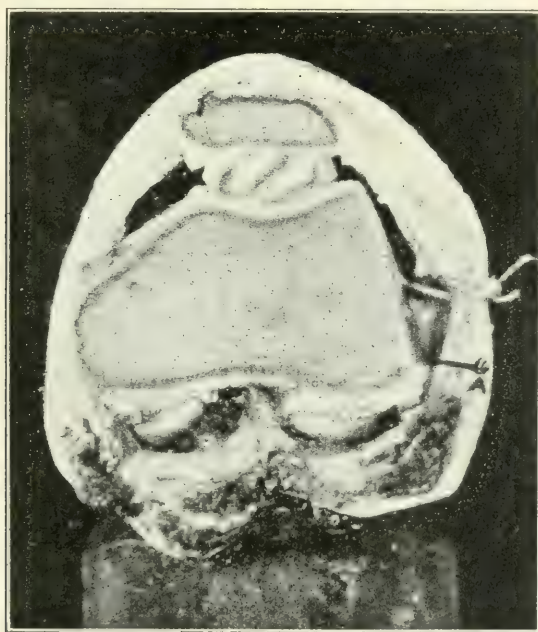


FIG. 140.—Transverse section through knee-joint, showing posterior and lateral pouches, with the route of communication between them. On the right of the figure the lateral pouch is propped open and an arrow marked A shows the track of communication. Note the level of the lateral reflection is that of the anterior margin of the lateral ligaments. (Hughes and Banks.)

The principle of treatment of recent wounds of the knee-joint are outlined as follows by Pool and Jopson in their report to the American Surgical Association, June, 1919: "Complete débridement of the tract



FIG. 141.—Route of infection from anterior to posterior pouches. The director is placed in the path of spreads of infection around the lower aspect of the femoral condyle. (Hughes and Banks.)

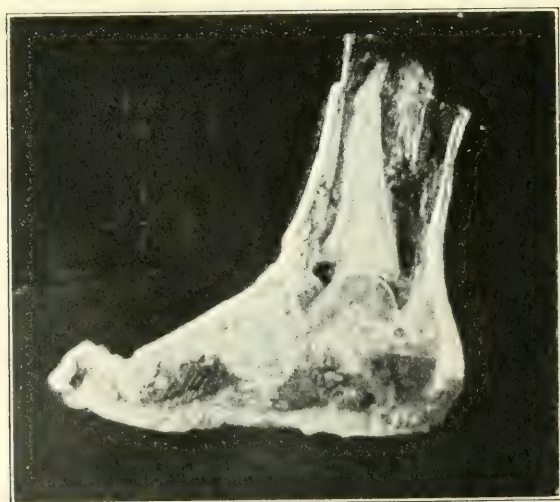


FIG. 142.—Section through an ankle-joint. Note the pouches anteriorly and posteriorly; also the bursa beneath the tendo Achillis. (Hughes and Banks.)



FIG. 143.—Section through shoulder-joint, showing the joint to be one large bursa sac. (Hughes and Banks.)



FIG. 144.—Section through the elbow-joint. Note divisions of synovial sac into anterior and posterior compartments by the articular ends of the bones. (Hughes and Banks.)

of the projectile through the soft parts and bone; removal of foreign bodies; thorough irrigation of the joint; distention of the joint with ether; absolute closure of the joint by suture; primary or delayed closure of the superficial parts according to the rules laid down for primary suture of the soft parts alone.

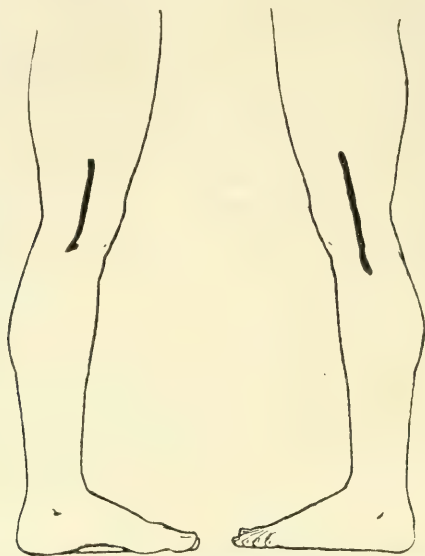


FIG. 145.—Line of incisions for opening knee-joint for extensive suppurative arthritis. The line of incisions runs along the level of the lateral reflections of the synovial membrane. (Hughes and Banks.)

In extensive involvement of the articular surfaces an effort should be made to save the joint, provided the conservable articular surfaces and soft parts are sufficient to warrant the hope of a useful joint. It must be remembered that stability in the knee is essential. When the joint cannot be saved, the question of extensive resection and amputation must be weighed carefully. Early active movement is the rule. With



FIG. 146.—Incisions on posterior aspect of joint for gaining access to the posterior pouches. (Hughes and Banks.)

suspicion of infection, aspiration should be done at once and a culture made. In suppurative arthritis the important feature is early drainage, which is best instituted by lateral incisions well back, though occasionally an incision elsewhere may be employed. No drains should be used. Splints are dispensed with, or arranged for support without joint fixation and free mobility and evacuation of the pus after the method of Willems is practised.

Metcalf¹⁵⁸ reports 88 joint wounds which were received at an evacuation hospital and he outlines in detail the foregoing principles and the treatment of each type of joint wounds.

In the Manual of the Injuries and Diseases of the War reprinted from the Official British Manual by the Surgeon-General of the U. S. A., a practical classification of joint wounds is given and the treatment outlined as follows:

Hemarthrosis with Small External Wound. If the effusion is considerable and its tension causes pain, the joint may be tapped, but, if the fluid cannot be aspirated, owing to the fact that firm clotting has occurred, good results will be obtained by deliberately opening the joint, washing out the clot and stitching up again without drainage. If the wounds are very small, it is only necessary to sterilize them superficially, unless they come in line with the incision when they should be completely excised. If there is reason to suspect infection of the effusion, the joint should be tapped, and the blood or synovia examined bacteriologically. If few and non-virulent organisms are found, the joint may be opened and washed out thoroughly with some warm non-irritating antiseptic and then closed.

Retained Missiles. Cases in which the projectile has lodged (a) within the synovial cavity, and (b) in one of the articular ends of the bones. When a retained rifle bullet *lies within the joint*, if the superficial wound is small and not inflamed, it may be left for a few days, the joint being meantime immobilized, but the better plan is to take no risks but to operate immediately. Free fragments of shells, or distorted rifle bullets must be promptly removed. (b) *Missiles embedded in the bones.* Bullets or shell fragments embedded in the articular ends of the long bones present difficult problems. Undistorted rifle bullets without serious destruction of bone or fissuring into the joints have remained undisturbed without causing trouble for long periods, but shell fragments, unless very minute, always carry in infective material and the retained body must be removed by the shortest and safest route which, preferably, should be by the original wound.

Open Wounds of the Joints. Cases in which the synovial cavity has been more or less widely opened (a) without damage to the articular surfaces, and (b) where fissured fracture or slight comminution of the articular ends of the bones coexist. These require the primary measures, débridement and wound closure, and often make remarkably good recovery if operated on within twelve to twenty-four hours.

Cases in which Extensive Comminution of one or more of the Constituent Bones has Occurred. The majority of cases in which gross comminution and soiling of either femur or tibia is present require amputation.

General Remarks Regarding Operation. The surgeon who exhibits the greatest care in technic, especially when removing foreign bodies and infected tissue, whether of the soft parts or of the bones, get the best results, and operations on gunshot wounds of the knee-joint demand the care of the most experienced and skilful surgeons. No drainage tubes

¹⁵⁸ Annals of Surgery, March, 1919, No. 2, lxi, 318.

should be placed in the joint. It is advisable in some cases to provide drainage down to, but not into, the joint cavity for twenty-four hours. Although cases occur in which the wounds cannot be closed, yet it is usually possible to suture the synovial membrane of the front of the joint, especially if the suprapatellar pouch is loosened from its upper and anterior connections and pulled down. In order to close the wound, a plastic operation may be necessary. Wounds through the posterior ligament cannot be sutured.

Amputation is indicated if the injury has implicated the main vessels to such a degree that the foot is cold; if one or the other popliteal nerves is so destroyed that it cannot be sutured later on; if the bones are much soiled and comminuted, and if sepsis, especially gas gangrene, is well established in the presence of comminution.

Depage¹⁵⁹ calls attention to the *results* which may be expected from *resections*. "They are not the same for the elbow- and shoulder-joints as for the knee-joint. In the first two, resection results in articular mobility, while in resecting the knee the movements of the joint are in a great measure destroyed. Therefore, for the shoulder and elbow one easily decides to do a resection, when one shuns it at all hazards in cases involving the knee."

Depage, with a perfect technic and extensive experience, reports complete success in but 89.8 per cent. of cases of primary closure of joint wounds. Thus there is a necessity for the early recognition of developing infection in the 10 per cent. of failures, for which a careful bacteriological control of the joint exudate has been developed. With the appearance of the symptoms of inflammation, subjective pain and fever, and the objective redness, tenderness, swelling, rise of temperature and pulse, the joint should be aspirated and careful bacteriological examinations of the fluid made.¹⁶⁰

1. In certain penetrating wounds of the knee-joint the infection carried in by the missile fails to produce inflammatory changes under appropriate methods of treatment. The fluid aspirated from the joint in such cases is mixed blood and synovia only, without hemolysis; smears show no polynuclear leukocytosis, and cultures are sterile.

2. The following physical characteristics of aspirated fluids from the knee-joint denote established infection: (a) Hemolyzed blood; (b) flakes; (c) pus. If non-hemolyzed blood be present, the fluid may be infected, but a non-hemolytic type of infection is generally less severe than a hemolytic type.

3. Smears giving polynuclear leukocytosis in the joint fluid indicate infection, even when cultures yield no growth.

4. Of all the organisms which may be cultivated from fluid aspirated from a joint, a long-chained streptococcus is the only one which consistently fails to be subdued by the vital resistance of the synovial membrane under appropriate closed methods of treatment. The presence of this organism in smears or cultures is a direct indication to open

¹⁵⁹ Transactions of the American Surgical Association, June, 1919.

¹⁶⁰ Hughes and Banks: War Surgery, William Wood & Co., 1919, p. 365.

the joint and institute antiseptic methods of treatment. The joint fluid in such cases is usually found to be purulent after the third day.

5. If the fluid aspirated after the third day be non-purulent, the joint inflammation should, in general, subside under the closed method of treatment.

6. The rarity of gas infection within the knee-joint, in spite of the presence of gas-producing anaërobes, supports the view that the joint synovial membrane has powers of vital resistance comparable to those possessed by the peritoneum and other serous membranes.

When the bacteriological and microscopical findings indicate the presence of streptococci in the joint fluid, or that infection is progressing, adequate drainage must be provided, and at once. The difficulties of providing such joint drainage needs no comment, the sections of the knee-, ankle-, elbow- and shoulder-joints demonstrate the anatomical difficulties present and indicate the proper incisions.

Articular Lesions. Willems¹⁶¹ states that no surgical procedure has been so dogmatically established as that of immobilization in lesions of the joints. At the German Surgical Conference of 1908, he reported about 30 cases of hemarthrosis or traumatic hydrarthrosis treated by puncture, evacuation of contents, and early movement, which attracted a large amount of attention. The joint injuries of the war have opened up a vast field for the application of this treatment and the results which he has obtained are among the distinct contributions to surgery. The technic varies with the lesions, but the general rule is active immediate movement. This mobility depends upon the patient himself who must make the active movements of the joints. This active movement cannot be replaced by passive movement, because the latter does not involve either the musculature or the nutrition of the limbs. Active movement should be immediate, commencing at the time the patient awakes from the anesthetic. The movements should be pushed to the maximum degree possible from the very beginning and continued without any interruption. The patient must not be left to himself, but must be supervised by a staff who understand the method. Irrespective of the extent of the bone lesion, Willems says that movement is always possible, though, of course, in varying degrees, and that the necessary movements, though tiresome, do not cause any real pain. He reviews the various types of joint lesions and describes the manner and degree of applying these principles in each case. The lesions reviewed are joint lesions without bone injury; joint lesions with slight bone injuries; joint injuries with medium and those with extensive bone injuries; cases with extensive loss of substance of one or of both epiphyses; epiphyseal fractures of various types.

In purulent arthritis, he feels that, with this new method, the results are more satisfactory than any other means available at the present time of combating infections of the joints. He points out the unsatisfactory results of attempts of drainage of joints by any existing method, and claims that it is anatomically impossible to accomplish it. After a pre-

¹⁶¹ Arch. Med. Belges, 1918, lxxi, 225.

liminary arthrotomy, the patient makes movements, and the pus is expelled, sometimes in jets. This is usually painless. When the movements are continued, the pus is expelled as rapidly as it is formed and a drainage of the joint satisfactorily assured. The formation of peri-articular abscesses is unknown, and there is usually a rapid improvement in the general condition. Joint motion is also preserved, and there is no ankylosis.

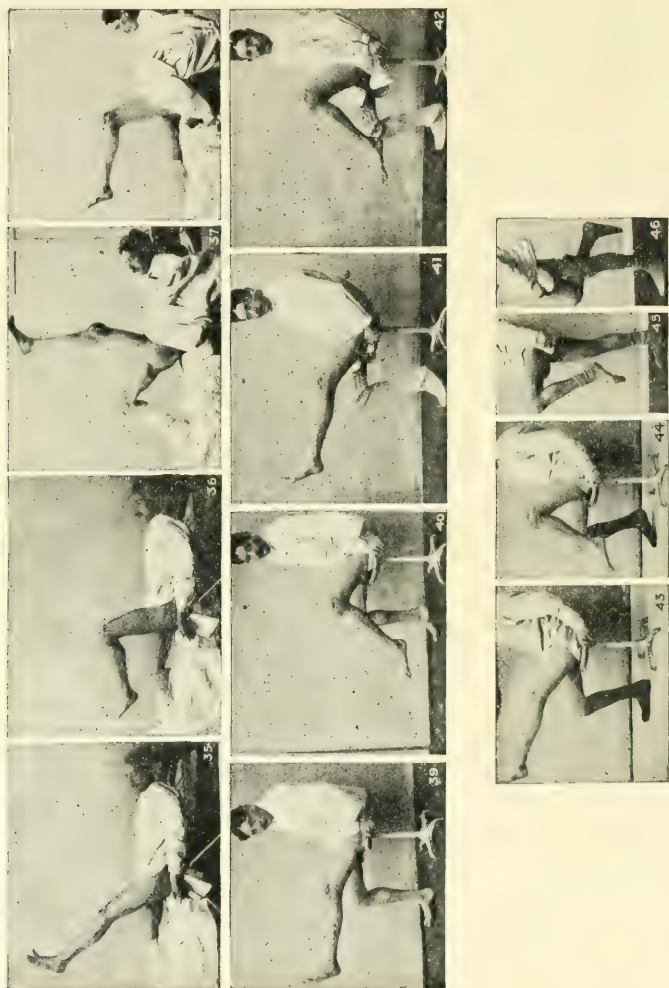


FIG. 147

In the editorial comment of the *Annals of Surgery*, vol. xlix, No. 2, February, 1919, page 212, a detailed report is given of Willems presentation to the Inter-Allied Surgical Conference, November, 1917, of his treatment by active movement of articular wounds which is by far the most complete account that has appeared.

Osteocartilaginous Joint Bodies. Henderson¹⁶² gives a radiograph showing the loose bodies arising from osteophytic growth of a hypertrophic arthritis of the knee. This was found to be the chief etiologic factor in the knee and elbow. Osteochondromatosis is the term applied

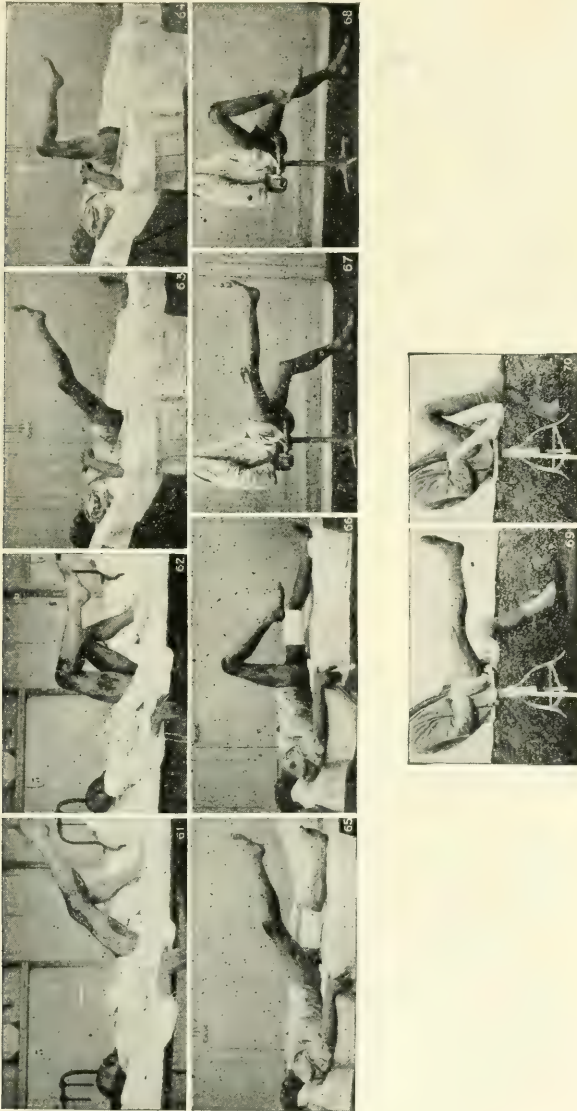


FIG. 148

for loose bodies which cannot be accounted for by hypertrophic arthritis, or osteochondritis dissecans (Fig. 356). The synovial membrane is thickened and pedunculated into teats. These pedunculated masses

¹⁶² Collected Papers of the Mayo Clinic, vol. x, p. 919.

vary in size, may be fibrous on the tip, and others, more advanced, cartilaginous. Many become bulbous, as they enlarge in size and drop off, wander about the joint and, being nourished by the joint fluid,

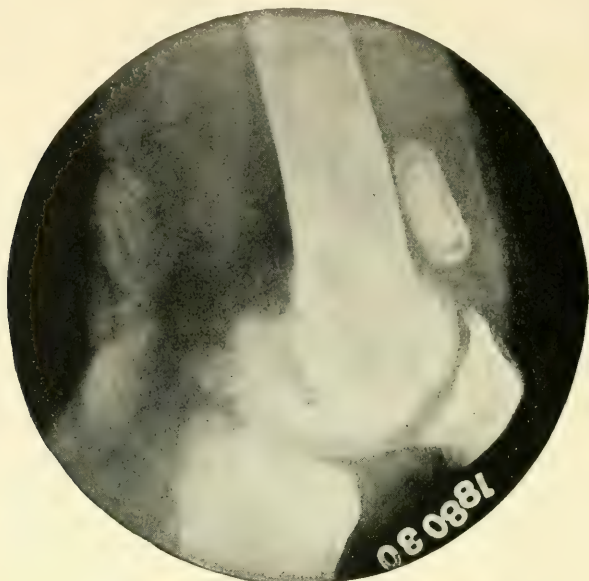


FIG. 149 (188030).—Loose bodies due to osteophytic growths of hypertrophic arthritis.

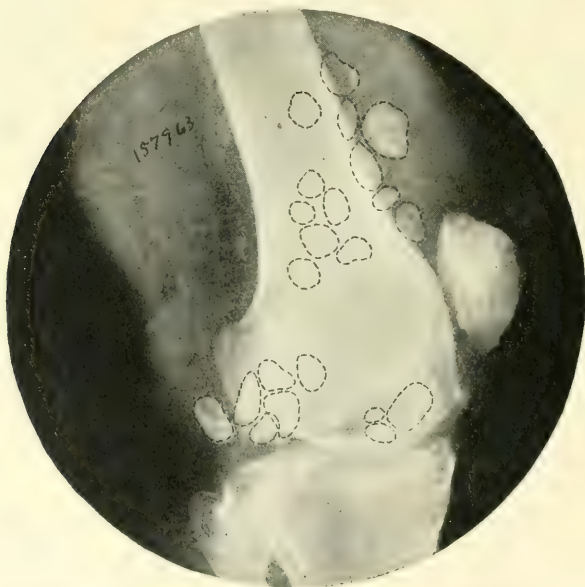


FIG. 150 (157963).—Multiple loose osteocartilaginous bodies in the knee-joint. Note the distended suprapatellar pouch,

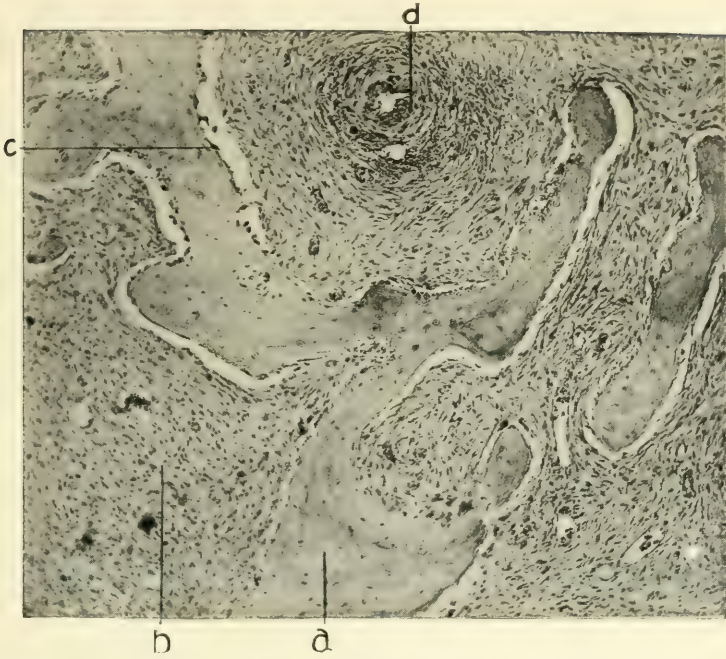


FIG. 151.—Case 13 (115338). General osteitis fibrosa cystica. Bone trabeculae and the fibrous connective tissue lying between. (Low power.) *a*, Bone trabeculae; *b*, area of fibrosis; *c*, cells along border of bone, probably osteoclasts and osteoblasts; *d*, whorl of fibrous tissue about a bloodvessel.

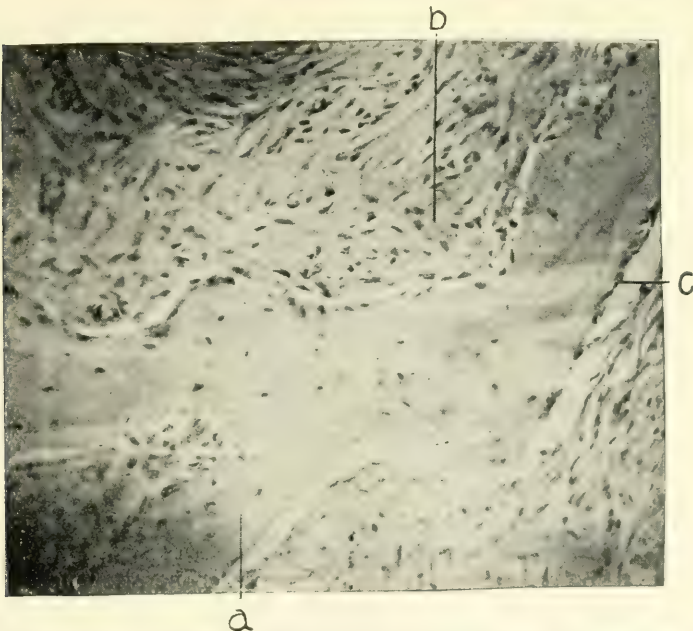


FIG. 152.—Case 13 (115338). General osteitis fibrosa cystica. (High power.) *a*, Bone trabeculae; *b*, area of fibrosis; *c*, cells along border of bone, probably osteoclasts and osteoblasts.

increase in size. Whether they are infectious in origin or new growths seems uncertain. Their treatment is entirely surgical.

When there is a single loose body, its removal may be simple. After carefully preparing the skin, the skin and subcutaneous tissues are anesthetized, the loose body is palpated and held between the fingers and is then securely fixed by passing a sharp cutting needle through the skin. By careful dissection, the body is exposed, removed, the synovia closed and then the skin. Exploration of the anterior compartment of the knee is obtained by splitting the patella longitudinally and the fibers of the ligament divided along the same line, if necessary, the quadriceps is also split. The exposure of the posterior compartment is through an incision six inches in length running down the middle of the popliteal space. Detailed descriptions of exposure of the elbow-joint and the shoulder-joint are given. The report is based upon 122 cases, in 2 of which the loose bodies were in the bursæ about the knee. The knee was by far the most common sight, the elbow next, the bursæ next and the shoulder last. The relief from surgical treatment depends upon the thoroughness with which the bodies can be removed and whether or not they were the sole cause of the symptoms.

Arthritis. Non-specific protein therapy in the treatment of arthritis is reported by Synder in the *Archives of Internal Medicine* (1918, No. 23, p. 224). He discusses the value of the reaction resulting from the introduction of bacterial endotoxin into the blood-stream. It is based upon 110 cases which he groups into the (1) acute; (2) subacute; (3) chronic.

The important dangers and contra-indications noted are: (1) Hemolysis occurring as the result of intravenous use of distilled water; (2) the treatment should start with small doses, five to ten millions; (3) when typhoid vaccine is chosen as the foreign protein agent, it should be remembered that if only one dose is given, the patient is sensitized to typhoid fever and to minimize the danger two more injections should be given; (4) a history of previous anaphylaxis should be carefully inquired into before using any vaccine.

His conclusions are as follows:

1. Intravenous injections of foreign protein give better results than the usual drug treatment in cases suffering from acute, subacute and chronic arthritis.

3. No injurious effect on the kidneys has been shown.

4. The treatment is not dangerous if the foregoing precautions are observed.

AMPUTATIONS.

Amputations and Artificial Limbs. The *Therapeutic Gazette* (January 15, 1919, vol. xliii, p. 17) gives statistics of more than 400,000 amputations made necessary by massive wounds of war; such an extraordinary number has of course created a renewed and vivid interest in the subject. The experience gained from the necessary intensive study of all details of the operation and the close coöperation between the surgeon and the maker of artificial limbs, has resulted in decided modifications of some of the old standard amputations and artificial

limbs. For instance, in the presence of infection, in war surgery, it has been customary to leave the wound wide open, either with short flaps or by a transverse section (guillotine). The sites of amputations are no longer matters of chance; they are definitely laid down.¹⁶³

About the shoulder at least two inches of stump must be left to make effective an artificial limb. And, if this much cannot be saved, the head of the bone should be left, as it is of advantage in fitting the glenoid cap.

In arm amputations, the greatest functional value is obtained from a bone level one inch above the condyles. In the forearm a stump is without value as a lever unless three inches of bone can be left. At the wrist, the greatest value is at the first joint, taking off the styloid process and thus conserving the power of pronation and supination. Every possible portion of the hand should be saved, short anterior and posterior flaps being the rule, except at the wrist, where long palmar flaps are used.

In the thigh, a two-inch stump, measured from the pubes, is the shortest that can be of value. A disarticulation is to be preferred when it is necessary to amputate above this two-inch level. The most useful femur is that where the amputation is made an inch above the adductor tubercle.

Again, two inches of tibia is the shortest that can be of service, and the bone level of greatest functional value is at or just below the middle.

The Spur-like Formations of Bone Following Amputation. Foot amputations anterior to the insertion of the tibialis anticus give useful stumps. Morgan¹⁶⁴ gives an account of 250 cases of amputations studied radiographically; the majority show irregularities in the end of the stump of the bone due to new bone formation varying from a small spicule to a large "wing." They are responsible for pain, discomfort, but most important for the persistence of discharging sinuses. The routine radiographic study of stumps and the unusual opportunities offered in the war has drawn attention to this condition. A number of references to it are found in military literature and the routine practice in the latter years of the war was to perform aperiosteal amputations instead of making the customary periosteal flap.

Care should be taken to strongly draw down the nerves out of their sheaths to prevent their being caught in scar tissue. A sufficient amount of soft tissue should always be drawn over the end of the bone.

In addition to the measures usually adopted for lessening congestion and preventing exostosis of the bearing surface, particular emphasis is laid upon the benefit to be derived from early functional use, careful graduated pressure on the end of the bone helping to give it a smooth and round shape. While in bed motion of the stump to the full limit of the joint should be accomplished daily. The necessary position of elevation of the stumps favors contractures, and, to counteract this tendency, the position should be changed several times a day. As soon as the wound is healed, daily massage should be instituted, after which the stump is re-dressed with cotton padding and flannel bandage, and the patient

¹⁶³ Review of War Medicine and Surgery, August, 1918.

¹⁶⁴ Archives of Radiology and Electrotherapy, 1918, xxiii, 154.

directed to press the end of the bandaged stump against a cushion placed in the bed or against a frame. The pressure exercise is to be discontinued and direct weight-bearing on the stump begun when the patient is able to leave the bed. Beginning first with a padded stool of the proper height, the amount of weight borne is gradually increased until the entire weight can be taken on the stump. As soon as the patient can stand alone for a long time without getting tired, a temporary leg, properly provided for bearing the stump end, may be fitted, and walking begun.

The Guillotine Amputation. Blake¹⁶⁵ writes: "As I look back it seems to me that the most reprehensible specific practices resorted to during the war were the guillotine amputations and the general tendency to sacrifice skin. The guillotine amputation is, as the name implies, a chopping off, without the formation of flap. It also necessitates a secondary amputation, with an additional loss of from 10 to 15 cm. of limb. It was supposed to be exceedingly efficacious for gas gangrene, and actually proved to be so when done above the highest point reached by the disease. When we consider, however, that the extension of gas gangrene is usually confined to a single muscle or group of muscles, and can, therefore, be eradicated by excising these muscles and leaving the others, the fallacy of the argument is exposed."

Gibbon¹⁶⁶ refers to the "no flap" or guillotine amputation as an unfortunate resurrection, "because of the frequent secondary hemorrhages, the slow healing extending over months, with the painful dressings and numerous secondary operations. The reflected skin flap amputation obviates these complications. The additional time required for making the reflections of the flap occupies only three minutes and cannot add to the shock. As soon as the wound has become clean, the flaps are ready to cover it; whereas, in the flapless method, a second operation, or the employment for a number of weeks of some appliance to draw down the skin, is necessary, and these in many cases fail."

Ashhurst, in the discussion of Gibbon's statements, did not agree with this sweeping condemnation. In cases where there was ample time for deliberate amputation and when the patient could remain at the same hospital for his subsequent treatment and secondary suture, he agreed that the flap amputation was to be preferred. However, when these two conditions were not attainable and where it was necessary to do the greatest good to the greatest number in a given period of time, the "chop" amputation had many advantages. (1) Its speed. (2) It exposed the minimum amount of tissue to infection, which was of vital importance to those patients who had to be immediately evacuated and were forced to depend upon more or less uncertain dressings and antiseptics during the interval before they reached their permanent hospital. (3) That the 10 to 15 cm. which Gibbon speaks of as being sacrificed at the secondary operations to which all "chop" amputations came was, as a matter of fact, sacrificed at the primary operation when skin flaps were made. (4) In his experience, if, during the first two weeks

¹⁶⁵ *Annals of Surgery*, May, 1919, No. 5, lxiix, 465.

¹⁶⁶ *Transactions of the American Surgical Association*, June, 1919

adequate traction was applied to the stump of a chop amputation, over two-thirds of them would heal with a very useful stump and without any further surgical treatment. (5) That the final stump resulting from a revision of a chop amputation was always more symmetrical and better adapted to prosthesis than those following secondary operations upon the lopsided stumps found in unhealed flap operations.

In civil surgery, however, these indications of Ashhurst's rarely occur, and it is hard to believe that civil surgeons will resort to the "chop" operation any more in the future than they have in the past.

New War Methods in Amputations, Stumps and Prosthesis of the Lower Limbs. R. G. Le Conte¹⁶⁷ gives to F. Martin, of LaPanne, Belgium, the credit of studying the results obtained by the old system of amputation in which, the surgeon's interest ceased often before the wound was fully healed and the comfort and usefulness of the man without a leg was left to the artificial-limb maker. The unsatisfactory results which he found, have led to the development of a new method of prosthesis based upon firm scientific principles just as are the corrections of refractive errors of the eye. "I use this simile advisedly for our treatment of the amputated limb in the past has been about as logical and scientific as the giving of an address of an optician to a patient requiring glasses."

1. Martin starts with the proposition that all legs differ in shape as much as the features of the face; that a man's walk is as characteristic of an individual as is his voice; and that strangely enough, his character is largely due to the shape of his legs. Therefore, to reproduce stability and comfort in walking, the exact counterpart of the lost limb must be reproduced in the artificial member.

2. The treatment of the stump, which eventually will actuate the artificial limb, is as important as the limb itself. The development of the muscles that control the joint above the amputation must be constant from the moment the wound is healed. This development is best attained by making the patient walk with a temporary apparatus.

3. Crutches speedily develop a lateral curvature of the spine in the one-footed man and should not be used. This lateral curvature is an effort of nature to produce stability by standing on one leg, the lumbar spine bowing toward the sound side. The curvature is quite apparent in two months and steadily increases with the use of crutches.

4. The immediate treatment of the psychic condition, always present in the mutilated, is of primary importance to the patient's future social value.

The surgeon's considerations in amputations are (1) to save life; (2) to save all tissue that will aid in actuating the artificial limb; (3) the healing of the wound in the shortest possible time.

PROVISIONAL APPARATUS. A temporary socket made of plaster of Paris reinforced with wire netting and carefully moulded to the limb and the bearing points has, in Martin's experience, made an ideal temporary socket. This socket is mounted upon two supporting sticks and a cross-bar fitting into the ends of a cylinder of wood upon which he can walk.

¹⁶⁷ United States Naval Bulletin, 1919, No. 2, vol. xiii.

This is practically the method which has been adopted in the reconstruction hospitals of the army, and these temporary sockets have proved just as satisfactory as Martin claimed them to be. As the stump shrinks in size, new plaster moulds have to be made, and there will usually be needed two or three changes before the form of the stump is sufficiently permanent for the artificial leg. "The two things which will do more to bring the patient out of the slough of despond, that always follows mutilation, are walking and work." This has certainly been true in our experience with the American soldiers. Many surgeons have had the privilege of assisting in, or at least observing, the work at the amputation centers in this country and this opinion is unanimous.

THE ARTIFICIAL LEG. Because every individual's legs have personal characteristics, varying lengths and angles of the thigh, lengths and curves of the leg and the relations of the axes of the knees and ankle, etc., it follows that if the artificial limb is to reproduce the functions of the lost limb it should copy exactly the lines and measurements of that leg. Therefore, any artificial limb designed for all men indiscriminately will assuredly be found to be adapted to no one individual's use.

Up to the time that Martin made his intensive study of the mutilated, the so-called American artificial leg was considered the best in Europe. It was designed on the following principles: (1) The axes of the knee and the axes of the ankle are superimposed in all points, since they are on the same frontal planes. (2) The axes of the knee and the axes of the ankle are parallel to each other and to the ground. (3) The longitudinal axes of the foot passing between the first and second toes passes through the middle of the axes of the ankle and, therefore, through the knee. (4) The longitudinal axes of the whole limb passes through the middle of the thigh, the axes of the knee, and the axes of the ankle. (5) The plane of the longitudinal axes of the foot and of the limb forms with the mid-plane of the body an angle of $18\frac{1}{2}$ degrees directed forward and outward. (6) The anterior border of the great trochanter, the external condyle, and the external malleolus are all on the same vertical plane.

These relations, almost in their entirety, are contrary to the anatomic principles of the lower limbs. They produce a straight leg devoid of normal angles, a foot externally rotated 18.5 degrees beyond the midline of the body, which necessitates the mounting of the foot on the leg at an angle of 110 degrees instead of at right angle as it normally articulates, making a *pes equinus*. The amputation stump, on being applied to a straight leg, must be vertical, therefore, in a position of abduction and external rotation, as the abductors are also external rotators. This faulty position at once vitiates the normal walking movement of the stump and requires a reëducation of these muscles, changing their normal movements to abnormal ones. The patient, unconscious of the anatomic defects, blames the weight of the artificial limb for his exhaustion. Practically none of these artificial limbs will stand alone, while an anatomically correct apparatus stands erect, and as firm on the ground as a riding boot with its tree. Martin's principles are to reproduce in the artificial limb all the lines, curves, angles of deflection and joint axes of the lost individual limb, and he models the new limb on the

measurements and projections of the remaining leg, reversing the projections to produce its counterpart. The stump enters this apparatus with its obliquity downward and forward, and the muscles which control the movement of the stump will act in their normal way when actuating the artificial leg.¹⁶⁸

Kineplastic Amputations. Putti¹⁶⁹ states that the possibility of being able to utilize the functional resources of an amputation stump so as to convey movements to the artificial limb was first suggested by Vanghetti, in 1896, at the time of Italy's second expedition into Abyssinia.

These motor flaps are based on the following general principles: Tendon and muscle—provided they have the necessary physiological protection (skin, vessels, nerve, etc.)—can generally be used for kinematic prosthesis, provided they admit of the formation of an artificial point of attachment to be protected in a similar manner. Up to the present time, the upper limb has been most frequently kinematicized, but the number of successful cases of the lower limb is daily increasing. The application of this method entailed a radical change of all preconceived notions regarding the ordinary methods of amputation. Skin flaps, muscular insertions, various bone and tendinous fragments and segments of limb, which would be superfluous for the classic amputation, are to be considered of the greatest value for future kineplastics.

When the inflammation has decreased and no further complications are to be feared, actual kinematicization may be proceeded with. The practical results that have been obtained through kinematicization have assured the author that the hopes placed in the principles of the method of modern theory of motor flaps can be accepted with confidence.

From a physiological point of view, motor flaps are capable of giving both the quality and quantity of the muscular masses that move them. Yet, practically, motor flaps will be made to perform their full function only if the artificial limb is perfectly adapted to their shape and their strength. It is essential, therefore, that the surgeon and the mechanic should work intelligently together in order to obtain the best results from this method.

Painful Amputation Stumps. Corner¹⁷⁰ cites five clinical types of pain in amputation stumps.

1. *Early Pain*, coming on immediately after the operation and dependent upon a endoneuritis resulting from the injuries to the nerves at the time of operation. If this is the only cause the pain disappears in a few weeks.

2. *Compression Pain*. This appears about two months after operation and at times steadily increases. This pain may pass away as the nerve fiber dies or the scar tissue ceases to contract.

3. *Inflammatory Pain*. This pain never passes off and may become paroxysmal and severe.

¹⁶⁸ Martin: *Prothèse du Membre Inférieur*, Masson et Cie., Paris, 1918.

¹⁶⁹ *Lancet*, No. 4945. vol, xciv.

¹⁷⁰ Proceedings of the Royal Society of Medicine, 1918, xi, 7; Review in Surgery, Gynecology and Obstetrics International Abstracts of Surgery, 1918, No. 2, xxvii, ii, 487.

4. *The Pain Produced by the Regeneration of the Nerve Fibers.* This is characterized by being more continuous and is accompanied by illusions as to the presence of the missing part.

5. This type, *non-nerve trunk pain*, is only diagnosed after a careful process of surgical elimination of all the nerve endings of the stump. It may be due to disease of the bone, or arise in muscle, joint, etc.

As to treatment, he outlines the following:

1. The excision of tender nerve bulbs together with a long piece of nerve to include any perineuritis or ascending neuritis.

2. The removal of the nerve by the epineural sleeve method advocated by Chappel,¹⁷¹ in which a half inch cuff of epineural tissue is turned back from the trunk and after the trunk is cut the cuff is pulled forward and closed with a circular ligature of catgut. Regeneration is not prevented but the end of the nerve develops as a pointed pencil instead of a bulb.



FIG. 153

RECONSTRUCTION.

In "THE DISABLED SOLDIER," by Douglas C. McMurtrie (Mac-Millan Co., 1919), this problem now looming before us with such grave import, is presented in a most complete manner, and the author clearly portrays the mistakes of the past in the care of war cripples as well as of disabled civilians.

"Beyond reaches of history, the disabled man has been a castaway of society. The primitive man came to anticipate the operation of the natural law of selection by putting the deformed to death as soon as they were born. The history of the social attitude toward the cripple is intimately associated with the history of the development of charity, and the giving of alms was a kind of obligation, and, with its performance, society felt that its duties to the crippled were fulfilled. Attempts were made in France, as early as 1657, to provide institutional care for the cripples, in which they could be taught to become self-supporting. But the first institution with a definite program for relieving the cripple

¹⁷¹ British Medical Journal, August 25, 1917, p. 242.

was established in Munich in 1832, and devoted entirely to the care of children. For the care of the disabled adult, there was no provision at all.

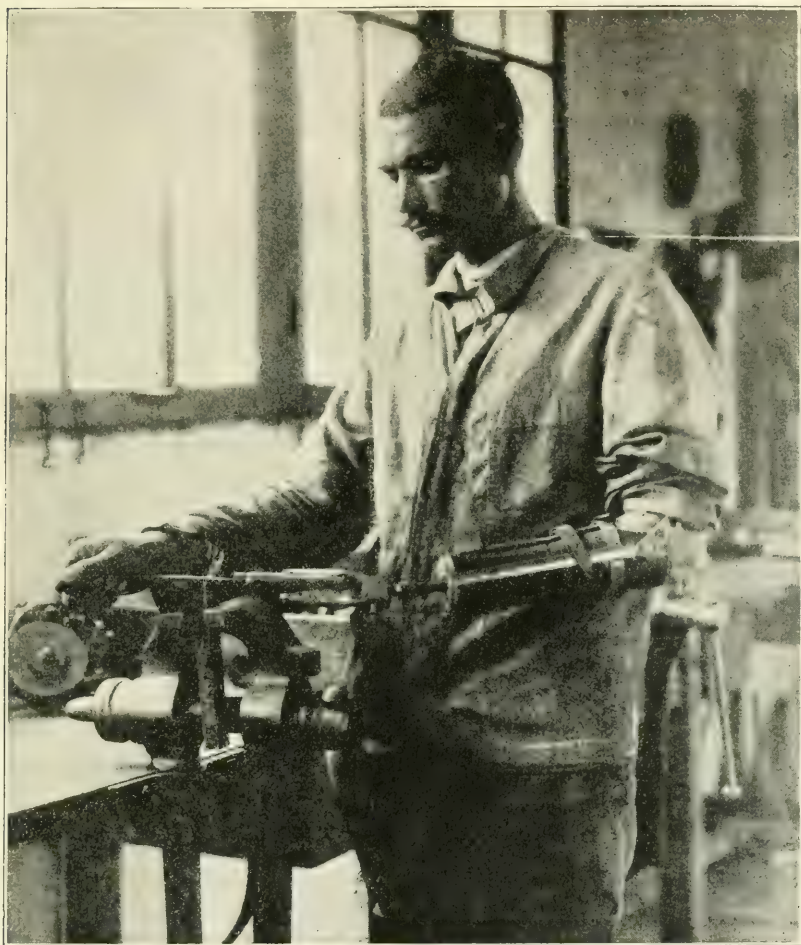


FIG. 154

From ancient times the disabled soldier has been left to shift for himself. In 1633, Louis XIV undertook the construction of the "*Hôtel des Invalides*" which has served as an inspiration for the soldiers' homes that were later established in almost all civilized countries. From the "*Invalides*" there developed a system of pensions for men living outside of the institution, and these two principles, institutionalism and pensions, have been gradually adopted by all civilized countries since then. In England, a similar system was evolved at a later date. The first general pension law enacted under the constitution of the United States was in 1792. During the Civil War the principle of fixed rates for specific

disabilities—the loss of a hand, the loss of a foot, both hands, both feet, both eyes, etc., was introduced, and this has since been applied, not only to military, but also industrial legislation.



FIG. 155

The lot of the industrial worker disabled by accident has, in the past, been even more unfortunate. He had no redress except through the

courts and the usual result was that he slipped back in the social scale, and frequently became dependent on relatives or friends, or on public

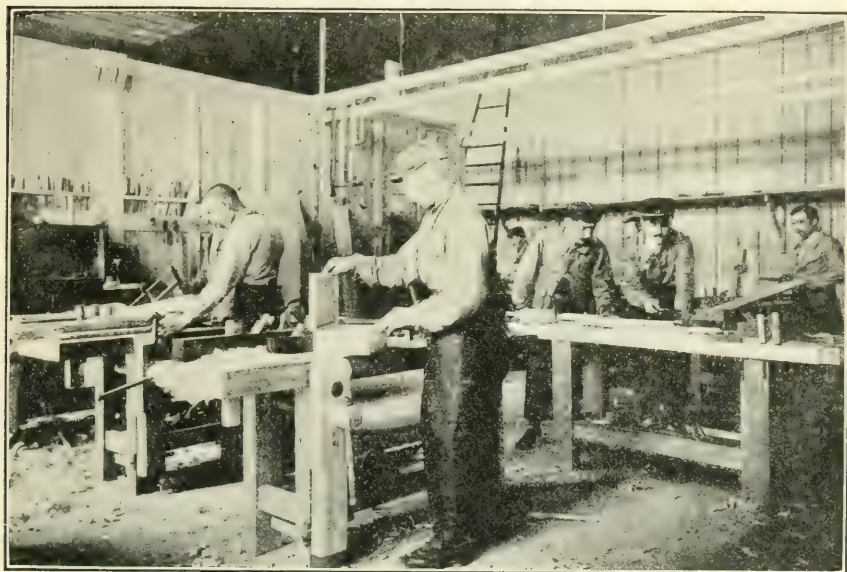


FIG. 156



FIG. 157

charity. The compensation legislation, though it has done much to remedy the injustice involved in industrial accidents, has only provided

a temporary relief in many instances, the compensation money supporting the man during the illness and period of idleness following the accident, but providing nothing constructive to put him back on his feet and restore him as a useful unit in the social economic plan. With the expiration of the compensation, he has too often become a public charge.

The care of the disabled civilian by compensation insurance, and the disabled soldier by institutionalism and pensions has in the past offered nothing constructive in restoring these cripples as economic factors in the community. The cripple has been an object of charity, and public opinion has conceived him as helpless and almost insisted that he become so. The few cripples who, in spite of these handicaps, have "come back" are unanimous in giving the testimony that their greatest handicap was not the loss of a limb or other disability, but the weight of public opinion.



FIG. 158

Fortunately, for a short time before the war successful attempts had been made, of a constructive character, looking toward putting disabled men on their feet. At Charleroi, in 1908, a successful school was established that trained disabled men for work which they could perform in spite of their disabilities and thus become self-supporting and avoid permanent idleness. This reëducation is peculiarly necessary in the crippled soldier, and every effort must be made by surgeons taking care of the wounded from the great war to prevent the economic loss to the country of these men. The task, in addition to coping with the mechanical factors, will entail the teaching of the men to look not at what was



FIG. 159

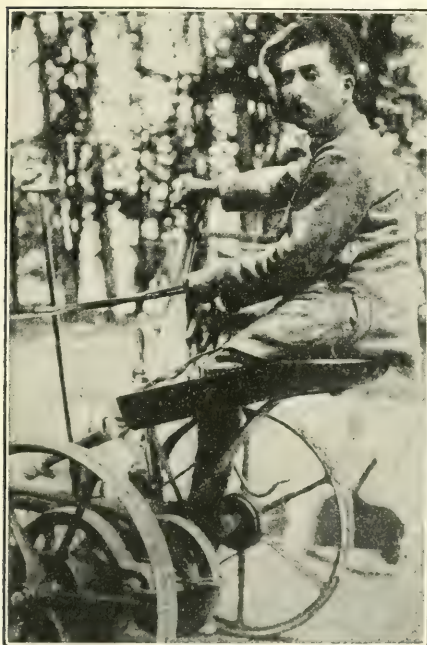


FIG. 160

lost but that which remains, and to so educate the unharmed faculties and muscles that they may become not mere onlookers, but active participants in the life of the community. (Bainbridge.¹⁷²) In addition to surgical care and artificial limbs, the disabled man must be given: (1) Functional reëducation, in order that he may make the best possible use of the unharmed muscles and of the new prosthetic apparatus; and (2) vocational reëducation, in order that he may become economically independent in case he is not able to return to his former occupation.

The first essential to such a course of rehabilitation is the necessary morale of the injured man. But equally important is the necessary change in the attitude of the community toward the cripple. McMurtie¹⁷³ points out that the success of any system of reëducation, from the cripple's standpoint, is contingent upon a clear understanding that pensions will not be prejudiced by such training, but that they will be based upon the physical disability caused by the injury, and not upon the final earning capacity. This, fortunately, is the attitude of our government.

The second essential is to insure that the man "carries on" to the state of self-support. The temporary war job, with amazing wages has been a great temptation to the wounded man, and a decided obstacle to the best plans for his reëducation. Furthermore, the automatic, regulated existence of the soldier in many instances makes him hesitate to return to the responsibilities of a voluntary enterprise, such as a course of training would be. This state of mind actually exists in a very large proportion of the men who have served in the army and is not confined alone to the enlisted man. In illustration, Major John L. Todd, of Canada, cites a case of a returned officer who found it difficult to make up his mind in the ordering of a meal from a menu placed before him. "A civilian is accustomed to order his meals, to do everything for himself. He goes into the army and serves four years, during which time all his meals are chosen for him and even the hour of mess is decided for him. Suddenly wounded, he is no longer fit to be a soldier, and is turned out into the world to unlearn those things which have been taught him with so much pain and effort."

Still another motive is that the soldier has been away from home for a long period, and his most urgent desire is to get back to his family and friends. Those of us who had the care of the wounded men as they were sent back to the reconstruction centers in the United States have all seen this reluctance to begin training anew. Against this desire to go home nothing seems to carry much weight. A discussion of the prospects of the future is of little value except when dealing directly with his family.

And, finally, there is, unfortunately, a tendency of the disabled soldier to conceive that he has done his duty toward his country and that he should now be supported for the rest of his natural days.

The community's part in such a program of assistance is, of course, a vital factor of its success but, up to the present time, the proper attitude

¹⁷² Special Number of the United States Naval Bulletin, January, 1919.

¹⁷³ Loc. cit.

of the community toward the disabled man has been more difficult to obtain than that of the cripple. Though the reëducational provision may be excellent, though the will and spirit of the men under training be of the very best, nevertheless the complete success of a rehabilitation program will depend upon whether the attitude of the public acts as a help or as a hindrance—upon whether the influence upon the individual ex-soldier, of his family, of his employer, and of the community at large, is constructive or demoralizing.

Of the public, the disabled soldier requires: (1) From his family a hopeful attitude instead of a depressing one; no maudlin sympathy but inspiration to make the best of the disability and the outlining of the possibilities of a fine future to look ahead to. His family should appreciate the importance of the offer of training of the disabled soldier for self-support and encourage him in every possible way to undertake it, and, when started, to give him all possible stimulation. "Stick to it; we are getting along all right and want to see you finish the job, now that you are at it."

In the readjustment of the crippled soldier to civilian life, the employer has a definite responsibility. It is not to take care of them from patriotic motives, assigning odd jobs irrespective of their earning capacity and thus frequently indirectly making them a charge on charity. Three evils result from such a course: (1) If the man is not earning his wages on this basis he usually finds himself out of a job after a short time. (2) That the man so patronized comes to expect as a right such gratuitous support. Such a situation breaks down rather than builds up character. (3) Such a system does not take into account the man's future or provide for him a constructive job in which he can develop skill and look forward to a future advancement. Thousands of cripples are now holding important positions in the industrial world, and a definite effort is being made by the government at the present time to ascertain the possibilities for the future placing of the rehabilitated soldier.

The community's responsibility is more complex. Unfortunately, we have all seen the various reactions—the hero worship in the form of social lionizing; the buying of drinks by the man on the street so that even in Washington intoxication of the wounded soldier was a common occurrence. The public must overcome the prejudice against the disabled, the incredulity as to his possible usefulness, the apparent will to pauperize and the reluctance of giving the handicapped man a chance. This has been reviewed at length with the hope that it will make clear the necessary features of any program for restoring the disabled soldier to self-respect and self-support must include a campaign of public education to convert the family, the employer, and the whole community to an attitude of rehabilitating the cripple instead of making him an object of charity, and in this campaign the surgeon must take an active part.

FUNCTIONAL REËDUCATION. That it is unwise to leave this reëducation to the period after the wounds have entirely healed is now generally recognized. Habits conducive to permanent helplessness and

reliance on others start during this period of wound healing; to prevent them is of great importance and to prevent is much easier than to cure them, after they become established. Little more can be done for a man with a broken spirit than for one with a broken back. The one remedy against the insidious deterioration of morale and the loss of muscle tone in the affected limb is through the medium of work, and, if possible, this work should be of a productive character.

The educational treatment should begin directly after the traumatism or the curative intervention. Early movement of the injured muscle or joint has nearly the same importance in the treatment of war wounds as sterilization. The nutrition of the damaged limb is improved by the increased healthy flow of blood to the part, and therefore the process of repair is accelerated. A close collaboration in this postoperative treatment should exist between the operating surgeon, the bacteriologist, the mechanotherapist, and the specialist in prosthetic apparatus. This functional reëducation is distinct from the workshops in which vocational reëducation is carried on. These mechanical movements are directed as a therapeutic measure applied to the specific injury. The willingness with which the American soldier enters into active purposeful functional reëducation has been in marked contrast to his unwillingness to submit to the passive mechano-, electro-, and hydro-therapeutic measures of treatment. To interest the average American private in any therapeutic measure he must be able to see the object of it, and, when his interest has been enlisted, his progress is definitely assured. Games, outdoor sports and the formation of classes of men with similar crippling makes it possible to develop the spirit of group work and competition.

VOCATIONAL REËDUCATION. At Lyons, France, the first official recognition of the necessity of training the mutilated to become self-supporting was in the form of an institute which was called the *Ecole Joffre*, which was opened December 16, 1914. Since then over one hundred centers have been established in France. Some indication of the number of disabled who require such training is shown by the fact that between June 30, 1916, and July 1, 1917, over seventeen thousand mutilated French soldiers completed courses in these schools.

TUMORS.

Ewing's book on Neoplastic Disease¹⁷⁴ is a remarkable contribution and one may refer to it with utmost confidence. His definition of tumor as "an autonomous newgrowth of tissue" includes all the definite knowledge of tumor growth that we have at the present time. He retains, as his classification and nomenclature, the accepted histological, regional and etiological methods.

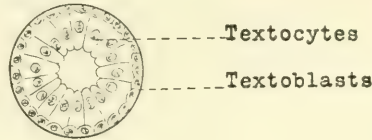
It is of interest in this connection to refer to the "Biologic conception of neoplasia—its terminology and clinical significance" by McCarthy¹⁷⁵. He suggests a classification and nomenclature based upon biological

¹⁷⁴ W. B. Saunders & Co., Philadelphia, 1919.

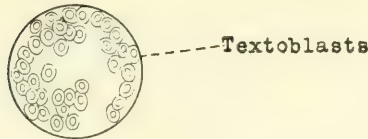
¹⁷⁵ Collected Papers of the Mayo Clinic, 1918, x, 1070.

relations of cytostructure and cytofunction. This nomenclature should include a description of the biologic activity of the cell as restauro-, expando-, or migro-adenocytoplasia. To this should be added names which indicate the tissue involved. The completed descriptive term is shown in Fig. 161. Thus this compound terminology includes the structure, the characteristic function, and the biostructural relationship and clinical values.

PRIMARY CYTOPLASIA



SECONDARY CYTOPLASIA



TERTIARY CYTOPLASIA

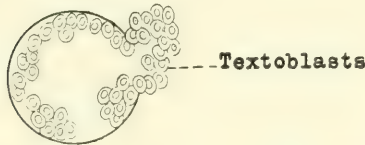


FIG. 161.—Diagrammatic representation of the original structural facts found in the mammary acinus. In primary cytoplasia the milk-producing cells (lactocytes) belong to the general group of tissue-cells (textocytes). The regenerative cells which constitute the stratum germinativum for the lactocytes have been called lactoblasts and belong to general reserve cells of the body which have been called textoblasts. In secondary cytoplasia the lactocytes (textocytes) have disappeared and there is a hyperplasia of the lactoblasts (textoblasts). In tertiary cytoplasia the lactoblasts (textoblasts) have migrated (in a biologic sense) from their normal acinic habitat.

In conclusion, one can readily agree that in this terminology these characteristics of a tumor are systematically and accurately portrayed, but the method though simple is not apparent upon first reading. Undoubtedly, it may serve as a basis for a more perfect terminology in the future.

A Practical Classification of Cutaneous Neoplasms. Van Buren¹⁷⁶ suggests, for the useful purpose of clinical diagnosis, considering them in

¹⁷⁶ Surgery, Gynecology and Obstetrics, March, 1919, No. 3, xxviii, 278.

three groups: (1) Those upon the skin; (2) those in the skin; (3) those beneath the skin.

DIAGRAM 2

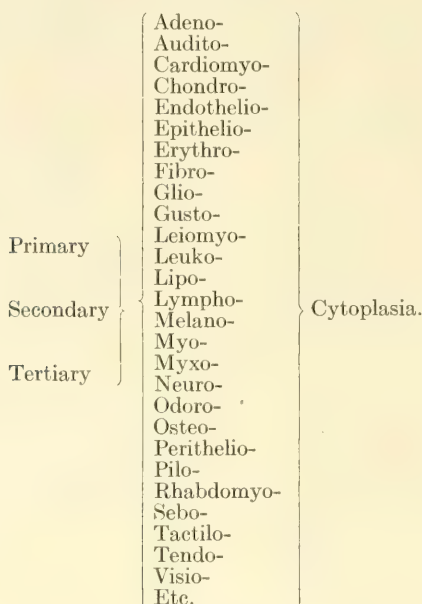


DIAGRAM 3

Location.	Gross form.	Biological and clinical reaction.	Tissue involved.	The degree of differentiation.
capito- collo- cranio- auriculo- naso- linguo- labio- laryngo- etc.	circumscribed diffuse cystic extracystic intracystic ductal intraductal periductal papillary polypoid ulcerated	{ Primary Secondary Tertiary }	{ audito adeno- cardiomyo- chondro- endothelio- epithelio- erythro- fascio- fibro- glio- gusto- leiomyo- leuko- lipo- lympho- melano- myo- myxo- neuro- odoro- osteo- perithelio- pilo- rhabdomyo- sebo- tactilo- tendo- visio- x-	{ cytoplasia: with or without { Primary Secondary Tertiary } differentiation

In Group 1 are those projecting markedly beyond the surface of the skin and in which there is apparently an increase in the more superficial layers of the skin, as the papillomata and epitheliomata.

Group 2 includes newgrowths within the skin, projecting little, if at all, beyond the skin surface and apparently involving the entire thickness of the skin. Fibromata, keloids, granulomata, pigmented moles, capillary angiomata, melanocarcinomata and sarcomata.

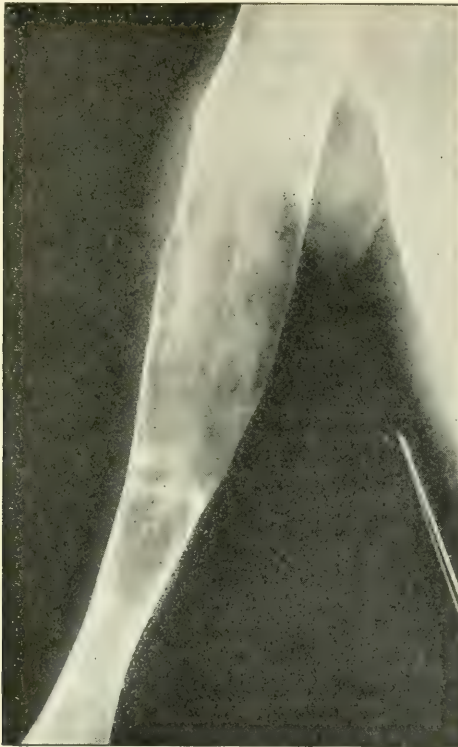


FIG. 162.—Case 17 (41571). General fibrocystic disease. Right humerus, showing fibrocystic change.

Group 3 includes the implantation, sebaceous and dermoid cysts, lipomata of a pure or fibrous type and cavernous angiomata. His suggestions as to the gravity of all these tumors should be accepted by every surgeon. (1) That every newgrowth of the skin should be excised as soon as one can decide that it is a newgrowth, and it should be submitted for microscopic examination. (2) That if any suspicion of malignancy exists a wider incision of the tumor should be planned than has been commonly practised in the past.

In contrast to the usual conception of tumors, Ewing presents them as specific diseases in which there are many variations. Though he still uses the histological classification he emphasizes their modification in type by the different organs or tissues in which they may occur.

Bone Tumors. Bloodgood,¹⁷⁷ in reporting a reinvestigation of the central medullary giant-cell tumor in 47 cases, feels convinced that the complete destruction of the bony shell, or its perforation at one or more points with infiltration of the giant-cell tumor-tissue, has not been associated with any difference in malignancy. As a result of his investigation, he admits that this is not the opinion of many surgeons and pathologists and quite a number still consider this type of tumor a giant-cell sarcoma. In his group of cases it has been found most frequently in the lower end of the femur, next the upper end of the tibia, then the lower end of the radius, all of which are bony portions which



FIG. 163.—Case 4 (106074). Osteitis fibrosa cystica of the left tibia in a patient, aged eleven years. Fractures occurred at the age of one and six years. The cystic areas are marked and invade the cortex as well as the medulla and are bulging out, causing deformity.

are most frequently subjected to trauma. He is convinced that it belongs to a special type of angioma or granulation tissue tumor, of which the xanthoma is a variety. They bleed freely, when explored without the Esmark band, just as an epulis and in all this group of tumors vascularity is a characteristic feature.

That many giant-cell tumors have remained well after curettement, and even after a second and third curetting, he feels is a strong evidence of their benignity or low grade malignancy.

¹⁷⁷ *Annals of Surgery*, April, 1919, No. 4, lxi, 345.

Bone aneurysms, in his experience, are usually malignant, and he proposes that the term malignant bone cysts be applied to the type which contain blood in contradistinction to the benign bone cyst, which, in his experience, has never contained blood. The giant-cell tumors of bone, however, are all very vascular, and resemble friable edematous granulation tissues, and, when the tumors are curetted from the bone shell, all operators have noted the profuse hemorrhage coming from the vessels after perforation of the shell.

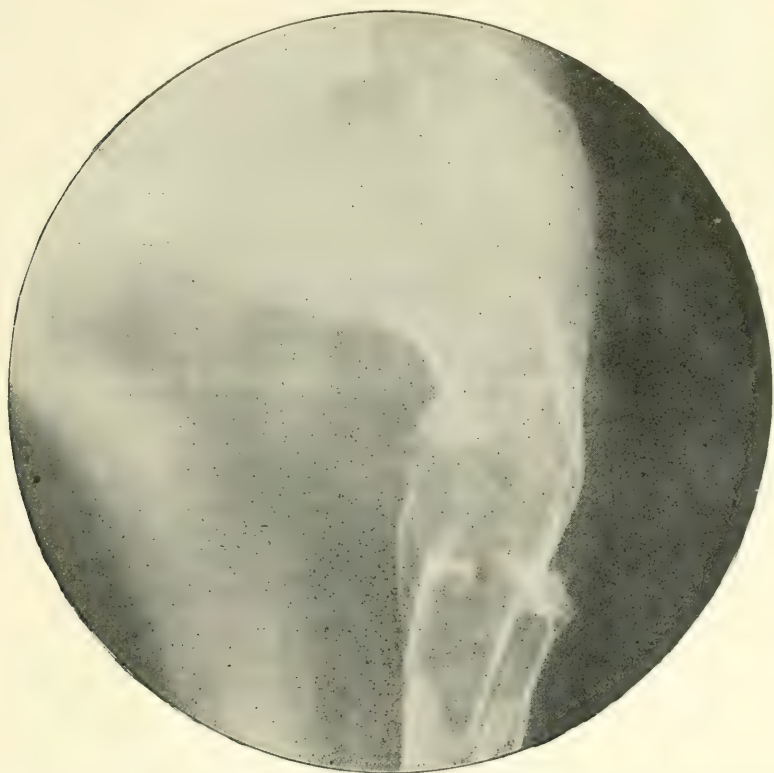


FIG. 164.—Case 13 (115338). General fibrocystic disease. Coxa vara, fracture of femur, and deformity. Thin cortex blending with medulla, the entire bone showing fine trabeculations.

Bloodgood feels that he has furnished evidence that there is no risk of recurrence in the benign bone cysts and that the surgeon and pathologist can and should learn to recognize the benign central giant-cell tumor at exploratory operation. Curetting offers no risk of recurrence and at the same time it is the only method of cure which provides perfect restoration. The curetting should be followed by the use of some tumor tissue destroying agent. He employs pure carbolic acid followed by alcohol. Hinds packed the cavity with zinc chloride solution. The neglect of this chemical destruction, he feels, explains some of the recurrences in the practice of other surgeons.

Cystic and Fibrocystic Disease of the Long Bones. Meyerding¹⁷⁸ concludes:

1. Cysts and osteitis fibrosa cystica may arise either from local or general processes.

2. Cysts, osteitis fibrosa cystica and giant cells may occur in the same bone.

3. Giant cells in moderate numbers, especially in the atypical forms, are not prognostic of malignancy.

4. Before the diagnosis of blood osteitis fibrosa cystica is made, it is necessary to rule out the general form; the most practical means being the radiograph.

5. Curetting and crushing in of the diseased wall is usually sufficient surgery.

6. The microscopic picture is clear and should not be confounded with malignancy.

7. The radiograph is of the greatest value and thoroughly diagnostic but cannot accurately determine the contents of the cyst; the localization in the diaphysis and the tendency to remain inside the cortex and periosteum are valuable signs of differentiating from malignancy, the epiphysis being free from involvement when non-malignant.

¹⁷⁸ Collected Papers of the Mayo Clinic, 1918, x, 871.

PRACTICAL THERAPEUTIC REFERENDUM.

BY H. R. W. LANDIS, M.D.

Acetanilide. It not infrequently happens that the physician is consulted to give relief from a toothache. A dentist is not always available and temporary relief, at least, is demanded. For this purpose Radcliffe¹ recommends the rubbing of a grain or two of acetanilide on the gums around the tooth. If a cavity is present, some of the acetanilide may be introduced into it. If a nerve is exposed, the pain may be intensified, but it passes off in a few seconds and the pain is relieved.

Acetylsalicylic Acid (Aspirin). This drug has come to be one of the common household remedies for the relief of pain. It rarely produces any untoward results, so far as known. Macht² reports the case of a man who took aspirin for the relief of a severe and obscure pain in one of his legs. He had been taking the drug for two and a half years when first seen; during the past two years he had been taking from five to twelve 5-grain tablets every day. Macht states that it is remarkable that in spite of the enormous quantity of the drug consumed, very few toxic symptoms were noted either by the patient or upon physical examination. The only features of a slightly abnormal character found were obstinate constipation, slight digestive disturbances, and a rather low blood-pressure.

An instance of marked intolerance to the drug is reported by Shelby.³ A woman who had been ordered aspirin in 5-grain doses because of a sore-throat developed the following symptoms shortly after the ingestion of one tablet: Itching of the scalp, swelling of the hands and white blotches over the face and body. These symptoms were quickly followed by swelling of the eyelids and violent irritation of the larynx. The latter condition produced alarming interference with the breathing. In a little less than three hours the patient could open her eyes and speak and felt quite comfortable.

Kramer⁴ reports the case of a physician whose urine showed the presence of sugar. He had been taking acetylsalicylic acid freely because of nervousness. Kramer examined also the urine of thirty soldiers who had been given 2 to 4 grams of the drug in twenty-four hours. The urine in all responded positively to the Trommer test for sugar.

Still another form of intolerance to acetylsalicylic acid is reported by Yagüe.⁵ During the influenza epidemic in Spain, this drug was

¹ Therapeutic Gazette, July, 1919, p. 532.

² Medical Record, November 2, 1918.

³ Journal of the American Medical Association, 1915, No. 17, vol. lxxi.

⁴ Abstract, Journal of the American Medical Association, August 31, 1918.

⁵ Ibid., February 15, 1919, p. 530.

freely used. The author encountered 8 cases in which marked gastric disturbances occurred, and in some of them severe hematemesis took place. The drug was given in the usual doses and intervals. None of the persons thus affected had complained of stomach trouble but practically all had a history of a "gastric fast." That the drug seemed to be responsible for the symptoms in these cases appeared certain by reason of the fact that the untoward effects disappeared when the use of the drug was suspended and returned when it was resumed. The ill-effects were more noticeable when the drug was taken in tablet form, swallowed without dissolving. No disturbance took place when the drug was given in the form of an enema. According to Yagié, everything seemed to indicate a direct local irritation of the mucous membrane of the stomach, acting like a caustic on a mucosa which was possibly the site of a latent ulcer. He does not believe that the hematemesis can be attributed to the influenzal infection as no cases were encountered except those in which either aspirin or salicylic acid had been taken.

Aconite. In a hospital with which he is connected Tarcketti⁶ encountered ten cases of *peripheral neuritis* in tuberculous patients. This he traced to the use of a prescription, much in favor, which contained aconite. Following the disuse of this formula no more cases of neuritis developed.

Alcohol. Now that prohibition has become, or will shortly become, an established fact it may not be amiss to call to mind that this state of affairs has not been brought about because the moral issue at stake. So long as the use of alcohol was combated on moral grounds, the fight against it made but little headway. Three factors it seems to me were responsible: (1) The growing conviction of the employers of labor that the use of alcohol made for inefficiency and the loss of many working days; (2) the impetus given to the movement by the adoption of prohibition as a war-time measure; (3) the moral cowardice of many of the politicians who feared to come out against a movement which had the support of many of their constituents. I believe that this same general attitude has been taken by many of the medical profession in regard to their repudiation of alcohol as an efficient therapeutic agent. In addition to these factors the medical profession has undoubtedly allowed the so-called moral element to largely govern its decision. There is certainly sufficiently good evidence to show that alcohol under certain conditions is an efficient drug and one we can ill dispense with. That some individuals, because of its stimulant or narcotic effects, use it to excess is no more of an argument against its employment medicinally than to condemn opium because many people become addicted to its use.

As has been well said, "Alcohol has about everything that its friends claim for it and about everything that its enemies claim for it, depending, however, upon the person who uses it and how it is used."

Hare⁷ has summarized his position in the matter as follows:

⁶ *Gaz. degli ospedali e delle cliniche*, Milan, August 1, 1918; *Journal of the American Medical Association*, December 7, 1918.

⁷ *Therapeutic Gazette*, September, 1918.

(1) Alcohol is a powerful drug and, therefore, if used carefully, capable of doing good. (2) Thousands of physicians prescribe it in illness. (3) Great care should be exercised by a body of men acting as representatives of their colleagues in condemning dogmatically what many of their colleagues believe correct. (4) Such action may jeopardize the reputation of a professional brother.

In this connection, it is interesting to note the opinion of a clinician of long experience. Shattuck,⁸ in an address dealing with the history of medicine during his lifetime, discusses the value of alcohol in *pneumonia*. He suggests that the pendulum may have swung too far away from alcohol in grave cases, and asks if fifty years hence alcohol will be regarded as always, everywhere, and in all circumstances the unmitigated poison that many would have us believe at present. Its undoubted abuse in the past does not affect the belief that in some instances it is life-saving but that the best results are obtained only under skilled supervision which contradicts the repetition of the dose while its toxic effects, such as flushing, or its odor in the breath persist.

Among the laity the use of alcohol (whisky) is looked upon as an antidote for *snake-bite*. Pope⁹ states that alcohol is responsible for 10 per cent. of the deaths from snake-bite. His directions for the treatment of this condition are as follows: (1) Apply a ligature above the bitten part. This must not be too tight, and sufficient only to obstruct the venous return, and even this should be relieved momentarily from time to time. (2) Expose the bitten part, cleanse or disinfect it, if possible, and incise the skin to the full depth of each puncture. (3) Apply suction to encourage bleeding either by a Bier cup or the mouth. If mouth suction is used whisky may be used as a mouth wash to prevent as much as possible infecting the wound with mouth organisms. (4) Inject a 1 per cent. solution of chromic acid hypodermically and then apply compresses over the site of the bite. (5) Following these emergency measures the patient should be kept quiet and given morphin if pain is present. Shock is combated with salt solution either intravenously or by the Murphy drip, the use of strong black coffee and the application of external heat. If antivenin can be obtained it should be used for the good it may do.

The *danger from* the use of *wood alcohol* or substances containing wood alcohol has been repeatedly emphasized. This warning is more than ever necessary as it is quite likely that various flavoring extracts, such as "Jamaica ginger," "Columbian spirits," etc., will be in demand more than ever now that prohibition has become effective. It is already known that wood alcohol has been used in the manufacture of these substances because of its cheapness. It is of course understood that only unscrupulous manufacturers would resort to this procedure.

The symptoms of wood alcohol poisoning are headache, dizziness, nausea, vomiting, and dimness of vision, often increasing to total blindness. These symptoms may terminate in coma and death. A characteristic of the severe cases which are not fatal, is total blindness coming

⁸ British Medical Journal, May 11, 1918.

⁹ California State Journal of Medicine, February, 1919.

on in a few hours or days, then partial recovery of vision, and finally more or less complete permanent blindness, which is due to atrophy of the optic nerves.

In all the cases reported so far the poisoning from wood alcohol have resulted from the drinking of substances containing the poison or as the result of inhaling the fumes arising from varnishes containing wood alcohol.

A unique instance of poisoning is reported by McKechnie.¹⁰ He believes that his case is the first instance to be reported in which the poisoning resulted from the external application of wood alcohol. A woman, aged forty-five years, with a sloughy surface on the leg over the site of a compound fracture, was ordered an alcoholic compress. After ten days' treatment she became very drowsy. After three days she complained of nausea and blindness; the face was flushed, the pupils dilated and the blindness was complete. Investigation showed that the alcohol used was the refined wood alcohol, Columbian spirits.

In spite of discontinuance of the application she became worse but eventually recovered. The optic atrophy was permanent, however, and her vision was reduced to distinguishing the movements of fingers. In this case the alcohol was applied to a raw surface for four days.

A comparison of ethyl and methyl alcohol shows that while the former is excreted to a limited degree by the eliminatory organs it is for the most part burned up as are ordinary foodstuffs. It is this latter attribute that warrants the assumption that alcohol may be a food.

Methyl alcohol (wood alcohol), on the other hand, is oxidized with difficulty. More than one-half of a non-toxic dose may find its way out of the body through the respiratory channels.

The elimination of the unoxidized portion is so comparatively slow, however, that the output from a single dose may continue during the entire week. As a result of this slow elimination and deficient oxidation, the poison is retained unduly long and thus gives rise to serious affects. The most vulnerable part of the body seems to be the optic nerve.

The *treatment of wood alcohol poisoning* is very unsatisfactory. Pohl¹¹ has reported some experimental results. He found that in animals blood-letting and the injection of Ringer's solution seemed to decrease the concentration of the poison in vitally affected tissues.

In order that physicians may know the conditions under which alcohol may be prescribed the Commission¹² of Internal Revenue has issued the following edict:

Physicians may prescribe wines and liquors, for internal use, or alcohol for external use, but in every such case each prescription shall be in duplicate, and both copies be signed in the physician's handwriting. The quantity prescribed for a single patient at a given time shall not exceed one quart. In no case shall a physician prescribe alcoholic liquors unless the patient is under his constant personal supervision.

¹⁰ Jour. Canadian Med. Assoc., March, 1918.

¹¹ Arch. f. exper. Path. u. Pharmacol., 1918, lxxiii, 204.

¹² Therapeutic Gazette, August, 1919.

All prescriptions shall indicate clearly the name and address of the patient, including street and apartment number, if any, the date when written, the condition or illness for which prescribed, and the name of the pharmacist to whom the prescription is to be presented for filling.

The physician shall keep a record in which a separate page or pages shall be allotted each patient for whom alcoholic liquors are prescribed, and shall enter therein, under the patient's name and address, the date of each prescription, amount and kind of liquors dispensed by each prescription, and the name of the pharmacist filling same.

Any licensed pharmacist or druggist may fill such prescription:

1. If his name appears on the prescription in the physician's handwriting.
2. If he has made application and received permit, Form 737, in accordance with the provisions of Treasury Decision 2788.
3. If he has qualified as retail liquor dealer by the payment of special tax.

No such prescription may be refilled.

Aloes. The use of aloes as a local sedative is recommended by Cock.¹³ The preparation he uses is a saturated solution of aloes in tincture of tolu. He has found this mixture of the greatest service in relieving the itching caused by insect bites. The preparation should be kept in a stoppered bottle, shaken before use, and by applying the stopper to each bite once or twice before scratching the relief is great.

Anthelmintics. The therapeutic effect of various anthelmintics on intestinal parasites has been studied by Sollmann.¹⁴ The effect of the drugs were noted in earthworms which were found to react with symptoms of toxicity to all clinical anthelmintics. Sollmann found that many substances, which are toxic to earthworms produce a primary irritation resulting in a withdrawal of the worm from the neighborhood of the toxin. He believes that this action of the anthelmintics often expels the parasite when the concentration does not rise sufficiently high to kill the worm. Fresh (germinable) *pumpkin seed* and *squash seed* are highly efficient, the active principle being soluble in water and destroyed by boiling. Sollmann believes that in view of the cheapness, availability, and presumably low toxicity to man, renewed clinical interest should be aroused in these seeds.

Antimony. The use of *tartar emetic* is now quite general in the treatment of several tropical diseases. Its use under these circumstances has been referred to in previous issues of PROGRESSIVE MEDICINE.

Guerrero, Domingo and Argüelles¹⁵ report on the use of Castellani's Mixture in the treatment of *yaws*. They employed this mixture in about 43 cases. Of 36 cases that continued the treatment, 24 recovered completely; 7 showed improvement; 7 showed no improvement at all and 5 relapsed in from two to five months after the lesions had completely healed. The authors believe the treatment to be very effective. Those cases which failed to respond or which relapsed they ascribe to the

¹³ British Medical Journal, September 7, 1918.

¹⁴ Journal of Pharmacology and Experimental Therapeutics, 1918, ii, 129.

¹⁵ Philippine Journal of Science, July, 1918.

fact that the treatment was suspended before the destruction of the spirochetes was complete.

Castellani's formula is as follows: Tartar emetic, 0.065 gm.; sodium salicylate, 0.65 gm.; potassium iodide, 4 gm.; sodium bicarbonate, 1 gm.; water 30 gm. This is given in one dose, diluted in four ounces of water, thrice daily, for adults and for children over fourteen years of age; half doses to children eight to fourteen years of age; one-third doses or less to younger children and not more than half doses to Europeans.

The use of tartrate of antimony and potassium is highly recommended by Pastore¹⁶ in the treatment of internal *leishmaniosis* in children. He injects the drug intravenously; in infants the jugular skin may be used. The tartrate of antimony and potassium is given in a slightly hypertonic solution. The initial dose is usually 1 cg., reaching 5 to 10 cg., after a very gradual increase extending over several months.

Bell¹⁷ treated a case of *kala-azar* by means of injections of a 2 per cent. solution of tartar emetic into the veins of the arm. Very often the injections caused an immediate attack of coughing with watery expectoration which passed off in a few minutes. No other untoward effect was noted except once the patient collapsed after an injection but quickly recovered.

In one case of *kala-azar* treated with tartar emetic, Law¹⁸ states that the patient was sterilized by his infection. He does not think that antimony should be given in large doses over long periods of time as it produces fatty changes in the liver and kidneys which may seriously damage the resisting powers of the patient, and may even cause death.

Law advises that when the antimony is given intravenously the patient should be confined to bed on the day of the injection and kept there until the next day. Any evidence of gastric or constitutional disturbance is a contra-indication to further injections. Not more than two injections a week should be given and the drug should not be administered in too concentrated a form.

Assuming that antimony is specific against the infecting organism, Law believes that it is essential to develop a test which will indicate that the *Leishmania donovani* have disappeared and the patient is cured.

Archibald and Fimes¹⁹ report a case of *bilharzia* in which they believe death was caused by tartar emetic. The initial dose was one-half a grain, followed after a days' interval with one grain, and after a similar interval by one grain and a half and then by two grains every second day. After the injection of the first two grains there was a little vomiting and a slight degree of phlebitis at the site of the injection. From this time on each injection was followed by considerable cough with frothy expectoration, which, however, regularly subsided after fifteen minutes. After the seventh injection there was usually slight elevation of the temperature. After a total of 33 grains had been given the urine was examined and found to contain blood but no bilharzial ova.

¹⁶ Pediatrics, February, 1919.

¹⁷ China Medical Journal, November, 1919.

¹⁸ British Medical Journal, June 7, 1919.

¹⁹ Journal of Tropical Medicine and Hygiene, April, 1919.

On the fourth day of an attack of influenza the patient suddenly collapsed and died within an hour. The findings at the autopsy indicated that death had been due to the tartar emetic as the pathologic changes in the organs could not be ascribed to bilharzia, malaria or influenza.

The treatment of human *trypanosomiasis* by means of the oxide of antimony is recommended by Masters.²⁰ He employed injectio antimonii oxidii which consists of antimony oxide dissolved in equal parts of glycerine and water and slightly heated. This is prepared in capsules of 1 and 2 c.c. containing $\frac{1}{100}$ and $\frac{2}{100}$ grain each of the drug, respectively. It is prepared and supplied in 100 c.c. sealed phials, of which 2 to 3 c.c. can be given at each injection. The drug is administered intramuscularly and not subcutaneously.

Masters believes that this preparation will eradicate the trypanosomes from the lymphatic circulation more readily than any drug or combination of drugs hitherto applied to the disease. The drug should be given in $\frac{3}{100}$ grain doses every other day until a minimal dose of $\frac{40}{100}$ a grain has been given.

If the trypanosomes are not cleared out by the $\frac{40}{100}$ dose, sodium arsaniolate, 0.77 gm., should be given in addition to more of the antimony oxide every fifth day.

A number of observations have been published during the past few years on the use of tartar emetic in the treatment of *malaria*. Many of them have been favorable to its use. Hughes²¹ has administered the drug intravenously in a limited number of cases. He concludes from this experience that the intravenous injection of tartar emetic is practically useless unless the doses are toxic to the patient. In other words, when small doses were used relief was not obtained. Hughes agrees with Greig's original statement that tartar emetic appears to be a general protoplasmic poison, that is, one possessing no specific power over the malarial parasite.

Apothesine²² is said to possess the following advantages over cocaine as a local anesthetic: (1) It is less toxic; (2) it is as efficient as cocaine; (3) it does not eventuate in habit formation.

Arsenic. It is well known that in susceptible persons or in those to whom arsenic is administered over a long period of time, arsenic causes certain untoward effects. The by-effects of arsenic are as follows: (1) A disagreeable granular feeling of the conjunctiva; (2) puffiness of the lower eyelids; (3) congestion of the hands and feet; (4) dryness of the throat; (5) disturbances of the stomach; (6) diarrhea; (7) increase in the quantity of urine; (8) urticarial eruptions; (9) erythemas; (10) pigmentations of the skin; and (11) hyperkeratosis of the palms and soles.

Hyperpigmentation is not an infrequent consequence of the administration of arsenic when given in large doses and for a considerable period of time. In Montgomery's²³ experience, however, it is not nearly so

²⁰ Journal of Tropical Medicine and Hygiene, July, 1918.

²¹ Indian Medical Gazette, February, 1918.

²² Memphis Medical Monthly, October, 1918.

²³ Medical Record, June 29, 1918.

frequent as irritation of the conjunctiva and puffiness of the lower lids. Montgomery reports the case of a man, over seventy years of age, whom he had treated a year previously with salvarsan and mercury for an old lues. He was given the *cacodylate of iron* because of a profound anemia, receiving in all nineteen doses of one grain each over a period of twenty-five days.

After taking the nineteenth dose he complained that he was beginning to look very dirty, although he bathed frequently. In stripping he showed characteristic arsenical, dirty, reticulated pigmentation of the skin across the lower part of the abdomen and on the temples and forehead. When he first saw the pigmentation, Montgomery thought of the *chloasma* of anemia, because the patient was anemic, and also because *chloasma* occurs most frequently on the face, especially over the forehead and temples. This, however, did not account for the more marked pigmentation over the lower part of the abdomen. There was also to be considered cachectic pigmentation from tuberculosis or malignant disease of the abdomen, or even Addison's disease. Syphilis was also a possibility.

That the pigmentation was due to the arsenic, however, there was no doubt; it appeared during the administration of the drug; it disappeared on ceasing to administer it; and it reappeared on resuming this form of medication, to disappear again when the drug was discontinued.

Montgomery considers the case of considerable interest because a relatively non-toxic arsenical preparation, a *cacodylate*, had caused a marked and characteristic pigmentation of the skin in an unusually short time.

Pusey has reported an instance in which a patient, seventy years of age, developed an intense pigmentation after taking, during one month, 500 minims of Fowler's solution.

Latham²⁴ has reported a case in which death resulted from a therapeutic dose of *arsphenamin*. In this case there was apparently a decided affinity of the poison for the skin or for the trophic nerves supplying it. From first to last all the toxic symptoms may logically be ascribed to impairment of skin function.

The fatality followed a therapeutic dose, equivalent to less than six grains of metallic arsenic. Diarrhea and vomiting were absent during all stages of the intoxication and nephritis was not a marked feature at any time and appeared only at the end. Arsenic was persistently present in the urine. This was remarkable in the absence of accompanying renal inflammation. Arsenic was found at necropsy in every tissue in which it was sought.

There was a high leukocytosis and eosinophilia, the latter related closely to the patient's resistance. The height of the leukocytosis followed that of the fever.

A similar experience is reported by Christiansen.²⁵ This patient was given 0.6 gm. of salvarsan at 10 A.M.

Twelve patients were given similar doses from the same package

²⁴ Journal of the American Medical Association, July 5, 1919.

²⁵ U. S. Naval Medical Bulletin, 1919, No. 1, vol. xiii.

without any of them having a reaction. Three hours later the patient in question had a severe chill, suffered from air hunger, and was delirious; the same night he coughed up some dark bloody material; the next day he had convulsions, and died that night. At the autopsy, there were found a specific aortitis, myocarditis, early central necrosis of the liver and acute hemorrhagic interstitial nephritis. Death was attributed to the toxic action of the arsenic on a heart weakened by the valvular lesion and the myocarditis.

In an experimental study of the cause of early death from arsphenamin, Jackson and Smith²⁶ notice that the earliest toxic symptoms consisted in a dilatation of the heart, perhaps mainly of the right side at first, a progressively increasing pulmonary blood-pressure, and a slow, gradual, but not severe, fall of the systemic pressure. The cause of the rise in the pulmonary tension they believe to be due, partly to the alkalinity of the solutions of arsphenamin used, and partly to the specific action of the drug itself. With large toxic doses the right heart may have to contract against a pulmonary pressure increased by 100 per cent. above the normal, while at the same time the left ventricle may be contracting against a systemic pressure reduced from 25 to 50 per cent. below the normal. This tends to cause instability of the heart and as a result delirium cordis may occur.

The reactions which occur in the other organs are variable and the reasons obscure.

Jackson and Smith studied the effects of a number of intermediary compounds occurring during the process of manufacture of arsphenamin. None of them is very poisonous and they cannot account for the variable toxicity of different samples of arsphenamin which may or may not contain traces of these.

They suggest that in those cases in which severe, acute, toxic symptoms suddenly manifest themselves, either during or shortly after an intravenous injection of arsphenamin, *tyramine* is more likely to be of benefit to the patient than any other known drug.

Montgomery has observed repeatedly such a small dose as one-fiftieth of a grain of arsenite of potash, or of arsenous acid, given three times a day, cause most annoying irritation of the neck of the bladder.

Geyser²⁷ states that in the treatment of *chronic anemia* the intravenous use of iron and arsenic is the only reliable method. The solution is free from all irritating properties and can be injected directly into the vein and so spread over the entire body surface in a few seconds.

He employs the *cacodylate of iron*. In the solution each 5 c.c. contains 1 grain of iron cacodylate. The effect on the blood is apparent after the second or third dose. Now and then it happens that the blood count does not improve after the four doses. In such cases there is usually lymphatic involvement. Twenty cubic centimeters containing thirty-one grains of sodium iodide are then injected until six to eight doses have been given, then followed by four weekly doses of iron and arsenic.

²⁶ Journal of Pharmacology and Experimental Therapeutics, November, 1918.

²⁷ New York Medical Journal, February 15, 1919.

Barium Sulphate. This substance has been advocated as a substitute for bismuth in x-ray studies of the gastro-intestinal tract. Several fatalities have followed its use. Bensaude and Antoine²⁸ state that these unfortunate results have been due to some one having blundered and dispensed the carbonate or sulphide in the place of the ordered sulphate.

Benzol. A number of cases of inoperable *cancer of the uterine cervix* have been reported by Bordarampé²⁹ in which he employed benzol locally. A tampon wet with pure benzol was applied directly to the neoplasm and allowed to remain in contact for five minutes when it was replaced by a dry tampon. In addition to this, two touches were given daily, consisting of two liters of hot boiled water and 50 drops of benzol. The fluid was stirred while the douche was being given. Under this treatment the neoplasm shrinks and heals over.

Benzyl Benzoate. For some time Macht³⁰ has been engaged in the study of the so-called "minor" alkaloids of opium. The interesting feature in regard to these alkaloids is their marked action on smooth muscle organs, namely, the intestines, pyloric rings, uterus, gall-bladder, urinary bladder, biliary ducts, seminal vesicles, vas deferens, bronchial rings. One of the great advantages of this alkaloid is that it is non-toxic.

The benzyl benzoate is administered either in the form of an alcoholic solution or, dissolved in oil, in the form of capsules; occasionally, intramuscular injections may be employed, in which case the benzyl is given in oil.

The dose of the alcoholic solution, flavored with some carminative, is from 10 to 30 drops in cold water. This dose may, however, be increased to one or even two drams every two hours (Litzenberg). As the after-taste of the benzyl preparation is often disagreeable a good plan is to make up a 20 per cent. emulsion with acacia in aromatic elixir of eriodietyon.

The following is an epitomized account of the conditions in which Macht found the drug of benefit:

1. Excessive peristalsis of the intestine, such as in *diarrhea* and *dysentery*. Here, truly remarkable results were obtained. Diarrheas of long standing, both in young and in old persons, were quickly checked by a brief employment of benzyl benzoate by mouth; and even in cases of dysentery also, patients were greatly benefited by it.

2. *Intestinal colic* and *enterospasm*, both of a postoperative and other character.

3. *Pylorospasm*, whether of functional character or produced reflexly by ulcers and neoplasms. In these cases the effects of the drug could be and were studied by the roentgen-ray method.

4. *Spastic constipation*, in which there was a tonic spastic condition of the intestine. This was relaxed by the antispasmodic action of the benzyl radical and the condition relieved.

²⁸ Bull. de la Soc. méd. d. hôp., May 2, 1919.

²⁹ Revista de la Assoc. medica Argentina, February-March, 1919; abstract, Journal of the American Medical Association, August 16, 1919.

³⁰ Journal of the American Medical Association, August 23, 1919.

5. *Biliary colic.* In a number of cases of gall-stone colic, patients were treated very successfully with benzyl benzoate.

6. *Ureteral or renal colic.*

7. *Vesical spasm* of the urinary bladder. Here also, a number of patients with these affections were treated with remarkable results.

8. *Spasmodic pains* originating from the contractions of the seminal vesicles. At least two cases have been found in which patients had such pains, in both of which great relief was experienced after the administration of benzyl benzoate.

9. *Uterine colic.* A record of a large number of cases of spasmodic dysmenorrhea, in which treatment by other drugs, by pessaries and even by curettage was unsuccessful, in which complete relief was obtained after one or two doses of benzyl benzoate by mouth.

10. *Arterial spasm.* Under this heading is induced a large number of cases of hypertension or high pressure. It was found that the administration of benzyl benzoate by mouth markedly lowered the blood-pressure, both the systolic and the diastolic, the effect, in practically all such cases, being more lasting than that produced by the administration of nitrites. Indeed, patients who did not respond to the nitrite treatment often responded with a falling blood-pressure after administration of benzyl benzoate. He has been giving benzyl benzoate by mouth to a large number of nephritics over long periods of time. No deleterious effects on the kidney function have been noted in any of these; the hypertension, however, has been greatly improved in most of them. The effect of the benzyl treatment on the arterial wall is seen from the fact that in cases of high blood-pressure benzyl treatment produces a fall, not only in the systolic but also in the diastolic readings. Thus, for example, in one case, after the administration of benzyl benzoate by mouth, the blood-pressure fell from 200-140 to 180-115; in another, from 320-160 to 255-140; in another, 194-100 to 178-80, and in another, from 215-145 to 190-135. A number of cases of coronary spasm (angina pectoris) seemed to be benefited by the benzyl treatment.

11. Cases of *bronchial spasm.* It was found that benzyl benzoate was capable also of producing relaxation of the bronchial spasm in patients suffering from true asthma. As the term asthma is applied to a large variety of conditions, and even bronchial asthma is etiologically not a single entity but is produced by a great many factors, it was natural to find that not all cases of asthma responded to the treatment. It may be stated, however, that wherever there were signs of bronchial constriction or spasm, benzyl therapy produced relief in almost every case. Macht has collected records of at least 200 such cases.

While the indications for the exhibition or administration of the benzyl esters, as described above, are manifold, it will be seen that the rationale of the treatment in all the cases is fundamentally one and the same, namely, that it is due to the inhibitory and tonus-lowering or spasm-relaxing action of the benzyl radical on smooth muscle.

An extremely frequent and at times a very difficult condition to relieve is *dysmenorrhea*. Litzenberg³¹ has had excellent results from the

³¹ Journal of the American Medical Association, August 23, 1919.

use of benzyl benzoate. He recommends the following formula in order to avoid the disagreeable after-taste alluded to above:

R—Benzyl benzoate	10 grams
Mucilage of acacia	5 “
Aromatic elixir of eriodictyon	35 “
Sig.—Give from $\frac{1}{2}$ to 2 teaspoonfuls, according to necessity.	

Litzenberg concludes that while the cause of dysmenorrhea is unsettled and the treatment, in the main, unsatisfactory, antispasmodics are logically indicated, for in spite of doubtful etiology the painful spasm of the uterine muscle is incontrovertible. He believes benzyl benzoate is preferable to atropine as it has an antispasmodic action and is non-toxic. Of 43 cases treated by him, 81.3 per cent. were relieved of painful menstruation. In 62.7 per cent. the pain was absolutely eliminated; in 18.5 per cent. it was greatly relieved.

The use of benzyl benzoate substance in the treatment of *lymphatic leukemia* is reported by Haughwout and Asuzano.³² The initial dose of benzyl benzoate employed by them was 10 drops of the 20 per cent. alcoholic solution, in water, three times a day, after meals. Later the dose was reduced to 5 drops, but when the symptoms recurred the original dose of 10 drops was resumed. As a result of this treatment, the patient gained in strength, was free from pain and discomfort and ate and slept well.

While they obtained good results in the case reported, the authors do not make any claim for the therapeutic efficiency of the drug, but they do believe that it is free from the danger of producing untoward effects and can be administered indefinitely without deranging the alimentary tract or the kidneys.

Bismuth.³³ It has long been recognized that the use of bismuth subnitrate, either in the form of a paste (Beck's) or as a dusting powder, is not devoid of danger. Before using bismuth the condition of the kidneys should be ascertained. It has been shown that the toxic effects produced by bismuth subnitrate are due to the transformation of insoluble salts into soluble ones, this transformation resulting from the action of the liquids of the organism and from the absorption of the newly-formed salts thus produced.

The drug should not be used as a dusting powder for extensive wound surfaces on account of the toxic effects which have been reported, while the use of Beck's paste, regardless of the successful results obtained, must be carefully watched and the possibility of poisoning guarded against. The preventive measures consist, in the first place, in not injecting large quantities of the paste and in carefully watching for the first symptoms of intoxication, in order to remove at once the mass of absorbed bismuth. To accomplish this, the fistulous tract or cavity need only be syringed out with sterile oil and then filled with the oil for about twenty-four hours in order to make an emulsion which can be removed by aspiration. The removal of the paste with the curette is a

³² New York Medical Journal, August 2, 1919.

³³ Ibid., March 29, 1919.

dangerous procedure because it opens the door to further absorption. However, when the paste has been eliminated the symptoms of poisoning finally disappear, and one should not place too much importance on the appearance of a mild cyanotic tint of the gums, as this symptom has been noted in some 20 per cent. of the cases, and none of the patients offered any other evidence of intoxication than this. On the contrary, these cases have given the best therapeutic results.

Acute suppurating processes should never be treated by bismuth paste for obvious reasons; the treatment should be limited to old fistulous tracts with thick fibrous walls. If one adheres closely to the directions given by Beck the danger of poisoning will be avoided to a large extent. Many, however, believe that it is much safer to use some other bismuth salt, for example, the carbonate.

Calcium. In an analytic study of the blood of infants suffering from *tetany*, Howland and Marriott³⁴ have apparently established the fact that the condition is due to a diminution of calcium in the serum. In 18 cases of idiopathic tetany they found the calcium greatly reduced. The administration of *calcium chloride* with the food proved efficacious. They state, however, that severe or dangerous symptoms must sometimes be held in check by sedatives until calcium in full doses produces its effect; when this is accomplished only calcium need be given.

Graves³⁵ has found *calcium lactate* serviceable in the treatment of *maniacal states*. The action of the drug becomes evident sometime during the twenty-four hours following its exhibition. He states that acute mental states are relieved without the production of the stupor so commonly observed following the use of sedative drugs. The action of the drug was found to be equally satisfactory in the restlessness and excitement of agitative melancholia and confusional states as with simple mania. Post-influenzal mental conditions have responded especially well to the use of calcium lactate.

In addition to its effect on the nervous system, the drug also influences the circulatory system in an interesting way. In maniacal states the pulse-rate is commonly rapid, at times almost uncountable, the blood-pressure is low and the artery feels flaccid. Following the administration of calcium lactate the pulse becomes slower, the artery normally constricted and the pulse wave stronger, thus indicating an improved action of the ventricular myocardium.

Graves gives 10 grains of the calcium lactate three times a day, with food, and when a response to its action has been obtained the dose is reduced to 5 grains. So far, he has not noted any untoward effects.

Camphor. The use of camphor in large doses is advocated by Feer³⁶ in the treatment of both *lobar* and *bronchopneumonia*. For children under six years of age, he gives one or two injections of from 5 to 7.5 c.c. of a 20 per cent. camphorated oil. In adults he gives 10 or 15 c.c. of the camphorated oil (20 per cent.) twice a day, or even more if needed. Feer has not noted any ill effects from the dosage he employs. He

³⁴ Bulletin of the Johns Hopkins Hospital, 1918, xxix, 235.

³⁵ British Medical Journal, April 5, 1919.

³⁶ Correspondenz-Blatt für schweizer Aerzte, November 30, 1918.

does not claim for this treatment anything more than a favorable action on the circulation which in desperate cases may be the deciding factor.

Giuseppe³⁷ also reports favorably on the use of camphor in the treatment of bronchopneumonia and influenzal bronchitis. He employs the drug in the form of a pill containing 4 grains of camphor. In mild cases one pill is given three times daily but in the very acute cases one pill every three hours may be given. The treatment is continued until the temperature drops and the pulmonary signs have cleared up.

A third report on the use of camphor in pneumonia is contributed by Stine.³⁸ On the appearance of signs of consolidation, that is areas of bronchial breathing and dullness, he gives 36 grains of camphor in olive oil intramuscularly every eight hours to men and every ten hours to women. In very severe cases this dose was given as often as every four hours for four doses and then every eight hours. Some patients received as much as 800 grains of camphor in seven days. Apparently these large doses produced no ill effects. On the contrary Stine believes that the low mortality he obtained in a large series of cases was to be attributed to the use of large doses of camphor.

The use of camphorated oil in the treatment of *pulmonary hemorrhage* is reported by Lunde.³⁹ He states that in every one of 11 patients treated with the camphorated oil the hemorrhage was arrested in a few minutes, just as if a finger had been pressed on the bleeding point. He used 3 c.c. of a 20 per cent. solution subcutaneously.

Personally, I do not put much reliance on the claim made by Lunde. One could very easily encounter 20 or even 50 cases of pulmonary hemorrhage all of which might be apparently controlled by any drug. The only type of hemoptysis that really needs treatment is that which keeps on recurring every day or every few days for an indefinite period. Aside from the use of large doses of atropine hypodermically I know of nothing that will control this type of bleeding aside from artificial pneumothorax. Of 16 patients suffering from recurring hemorrhages artificial pneumothorax has been successful in all but two. In the two failures it is quite possible that the pneumothorax was induced on the wrong side. If both lungs are diseased it is not always possible to ascertain on which side the bleeding is taking place.

Benz⁴⁰ gives an interesting account of *poisoning from camphorated oil*. Twenty children, varying in age from four to ten years had been given from one to one and a half teaspoonfuls of medicine, presumably castor oil. The symptoms appeared about three-quarters of an hour after the administration of the medicine. The symptoms ranged from nausea to unconsciousness and convulsions. One of the severest cases was unconscious and rigid, with the head thrown backward. While the color was good the lips were intensely livid. The skin was cold and dry; the pulse and respirations very rapid. The jaws were locked and

³⁷ British Medical Journal, December 28, 1918.

³⁸ Missouri State Medical Association Journal, January, 1919.

³⁹ Abstract, Journal of the American Medical Association, January 25, 1919, p. 318.

⁴⁰ Journal of the American Medical Association, April 26, 1919.

there was a tetanic contraction of the masseter muscles and in addition rigidity of the cervical muscles. The arms showed tonic contraction and the legs were extended. The lips were fixed and staring with the pupils equally dilated. In all the cases there was a strong odor of camphor. Although the symptoms in some of the children were alarming, they all recovered. The only treatment necessary seems to be the removal of the stomach contents by means of an emetic.

Charcoal (Carboligne). I have used this substance very frequently in patients who suffer from the formation of large amounts of *gas in the intestines*. Its use is often attended with excellent results. Lentz⁴¹ advises the use of charcoal in cases of chronic disease of the small intestine and other conditions in which absorption of bacterial and other products poison the system. He gives the charcoal as far as possible from the meals, and in the smallest amounts that prove effectual in order to refrain from interfering with the digestive juices. From one to three heaping teaspoonfuls of the charcoal (5 to 10 grams) are given at bedtime, stirred well into a glass of water or linden flower or valerian tea. In acute conditions up to 20 grams may be taken. During the war, acute diarrheic cases were sometimes treated with as much as 80 to 100 grams in twenty-four hours.

In cases of *chronic putrefaction* and *fermentation indigestion* and catarrhal conditions of the small intestine Lentz keeps up this continuous mild charcoal treatment for years, with occasional periods of suspension. If the charcoal produces constipation he prescribes a course of alkaline mineral waters, a glass hot or cold on rising. This clears the charcoal out of the digestive tract so that digestion can proceed unhampered. The only untoward effect he has noticed is that occasionally the charcoal may form in hard lumps in the intestines.

Lentz quotes the results obtained by Lichtwitz in the treatment of *pernicious anemia* by means of charcoal and frequent lavage of the stomach. This treatment is based on the assumption of gastro-intestinal auto-intoxication as the cause of the anemia.

Chaulmoogra Oil. In the treatment of *leprosy* the only remedy that has withstood the test of time is chaulmoogra oil. The great difficulty with it is that the stomach does not tolerate it well. Cumston,⁴² in a summary of the treatment of leprosy, reviews the various ways in which the oil has been administered. It may be given in doses of 5 drops in the morning or evening before or after meals; this dose may be increased from four to six drops daily until 100 or 200 drops are taken in two or three doses in twenty-four hours. The maximum dose may be continued for two or three months. The oil is given in hot tea, or an infusion of peppermint or in capsules containing 15 gm.

In certain countries the oil has the consistency of butter and is taken in the form of a bolus.

Some advise that the oil be given in keratin coated pills of 15 gm. each, to which some menthol may be added to subdue the colic produced by the oil. From five to ten pills are given daily at first, and the number

⁴¹ Correspondenz-Blatt für schweizer Aertze, October 12, 1918.

⁴² Therapeutic Gazette, March, 1919.

is progressively increased until 30 or even 40 are taken in twenty-four hours.

In most instances the administration by mouth sooner or later leads to gastric intolerance. This is to be treated by an exclusive milk or vegetable diet or by giving sodium bicarbonate with the oil. Lactic ferments have also been recommended for the same purpose. The ferment is given night and morning with the oil, and this is followed by one or two teaspoonfuls of lemon or orange juice slightly sweetened. The patient is advised also to drink freely of lactose water.

An exclusive milk diet (3 or 4 liters, taken frequently in small amounts) is said by some to prevent gastric disturbances and at the same time assume proper renal elimination.

In order to avoid the gastric disturbance and enable one to continue the treatment indefinitely, various hypodermic solutions have been recommended. That introduced by Heisser several years ago has attracted considerable attention. Reference has been made to Heisser's formula in the last two issues of *PROGRESSIVE MEDICINE*.

In order to get rid of the irritant properties in the oil several of the active principles have been extracted. The most effective of these seems to be *gynocardic acid* which may be given either by mouth or subcutaneously. Internally it is given in capsules containing 5 mgm. of the acid and 20 cgm. of the chaulmoogra oil. Instead of the gynocardic acid, the gynocardate of sodium or magnesium may be employed.

The use of gynocardic acid in the treatment of leprosy was referred to last year in commenting on an article by Rogers. The acid, although less irritant, does not seem to be as effective as the chaulmoogra oil itself.

Muir⁴³ has used *sodium gynocardate* "A" in the treatment of leprosy with alleged good results. A 3 per cent. solution of sodium gynocardate "A" in distilled water, with 1 per cent. of pure phenol and 1 per cent. of sodium citrate, was prepared, and sterilized by boiling in a flask immersed in another vessel containing water. Of this solution from 0.5 c.c. up to 5 c.c. were given intravenously three times a week. Tablets of the same drug were at the same time given by mouth, but so far as could be judged, the oral administration made little or no difference. The initial dose of 0.5 c.c. was increased 0.5 c.c. at each injection. All of the patients were anesthetic and in 20 of them tubercular nodules were also present. Three patients who had been ill five, four and eighteen years, respectively, lost all traces of the anesthesia and in addition the nodular swellings disappeared. The most rapid progress was recorded in the youngest patients and in those who had been ill for the shortest time; but this latter does not always hold, as the disease may advance more rapidly in some cases than in others.

Carthew,⁴⁴ in a report on the use of gynocardate A, concludes that the relief given the patient by the improvement of the general health, together with the almost universal improvement of the symptoms indicates the use of this drug in all cases of leprosy of whatever type or

⁴³ Indian Medical Gazette, June, 1918; April, 1919.

⁴⁴ Ibid., November, 1918.

duration. He employed it in 9 cases of the maculo-anesthetic type and 4 cases of mixed leprosy. All the lesions disappeared in 2 cases; very marked improvement occurred in 3 cases; considerable improvement occurred in 6 cases; some improvement was noted in 1 case and in 1 no favorable results were noted.

Hollmann and Dean⁴⁵ have reported their experience with the use of chaulmoogra oil and a fatty acid isolated from the oil. Twenty-six patients were treated with fractions of the fatty acid isolated by Dean from the chaulmoogra oil. This method is superior to the use of the oil itself as the required dose is smaller, more easily administered and there is more marked and more rapid amelioration of the disease. Of 26 patients treated, 17 showed marked improvement; 1 patient showed slight improvement, being under treatment only about three months. Of the 26, 8 have become bacteriologically negative in less than two years.

Rogers⁴⁶ has also reported a small series of cases treated with sodium gynocardate A; 13 out of 14 of his cases made steady progress toward recovery, and in several cases apparently the disease was completely arrested and clinically cured.

The use of chaulmoogra oil in the treatment of *tuberculosis* is reported by Hernandez.⁴⁷ This has been suggested before, the idea being that as both the bacillus of leprosy and tuberculosis are acid-fast they may be influenced by the same drug. Hernandez found that the addition of 2 per cent. chaulmoogra oil to the culture medium always prevented the growth of tubercle bacilli. It also seemed to exert some beneficial influence in guinea-pigs. Six tuberculous patients were treated with the oil and apparently with good results. The best results were obtained with the injection of not more than 1 or 2 c.c. at twenty or thirty days' interval.

Chenopodium. This drug has come into such general use in the treatment of *uncinariasis* that it is well to be familiar with the untoward effects it at times produces. In an analysis of 103 patients who were given the oil, Roth⁴⁸ states that 29 showed signs of reaction. The common symptoms noted are nausea or vomiting, headache, deafness and general depression. Roth emphasizes especially the occurrence of deafness which is by far the most disagreeable after-effect following therapeutic doses. It occurred in 20 per cent. of the cases, varied in intensity from very mild to a complete loss of hearing, and may last anywhere from a week to several months. In 4 cases the deafness has persisted for two years after the treatment.

Roth cautions against the use of chenopodium unless the case can be carefully observed before and after the administration of the oil. He warns against employing it in a patient suffering from a high grade of anemia or of repeating the treatment within ten days.

Oppikofer⁴⁹ has also called attention to the occurrence of deafness

⁴⁵ Journal of Cutaneous Diseases, June, 1919.

⁴⁶ Indian Medical Gazette, May, 1919.

⁴⁷ Gaceta Medica de Caracas Venezuela, June 30, 1910; Journal of the American Medical Association, October 5, 1918.

⁴⁸ Southern Medical Journal, November, 1918.

⁴⁹ Correspondenz-Blatt für schweizer Aertze, February 8, 1919.

following poisonous doses of chenopodium. He had evidently not seen the article by Roth, as he states that the case observed by him added another to the four already recorded in which deafness had been associated with the use of chenopodium.

In the treatment of *amebic dysentery*, Barnes and Cort⁵⁰ prefer the oil of chenopodium to emetine. The drug is used as follows: In light cases a saline is given before the chenopodium is administered, followed within an hour by one and a half ounces of castor oil. In more severe cases the preliminary saline is omitted, and 2 c.c. of the oil of chenopodium is given in one and a half ounces of castor oil at a single dose. In other cases the oil of chenopodium, emulsified with gum acacia, was administered by rectum. In such cases the anal mucosa must be protected with petrolatum, and it is well to terminate the injection with two ounces of an inert oil. The buttocks should be elevated, the enema given slowly and with great care, the first dose not exceeding eight ounces in the adult. The enema should be retained for an hour if possible. If the parts are well protected with petrolatum the patient does not suffer from the intense burning sensations which would otherwise accompany the expulsion of the enema. In practically every case, after treatment by one of the foregoing methods, there was marked improvement in the condition, as blood and mucus disappeared from the stools on the second day after treatment. They have also used oil of chenopodium with good results in the treatment of amebic cysts.

As a result of their experience Barnes and Cort conclude: (1) Oil of chenopodium relieves promptly the clinical symptoms in many patients with chronic and subacute amebic dysentery. (2) Oil of chenopodium administered by mouth or rectum possesses marked power as an amebicide, as shown by the rapid disappearance of amebæ from the stools, following its administration. (3) There is a tendency to relapse in some cases, but in their series this is not greater than with the use of emetine. (4) The oil of chenopodium may be safely administered when combined with castor oil in a single dose.

Chloral, its derivatives and compounds belong to that group of soporifics which depress the central nervous system. Chloral has no effect on pain and is therefore contra-indicated in cases of insomnia due to pain; on the other hand, it is the remedy of choice in cases of *insomnia due to nervous excitation* especially when such excitation is of spinal or reflex origin. For the control of the insomnia and extreme nervousness encountered in individuals threatened with or actually suffering from delirium tremens chloral is a most efficient drug. In these cases it is best given by rectum in combination with the infusion of digitalis.

In the administration of chloral, Diner⁵¹ states that the drug should be given in high dilutions because it is irritating to the skin and mucous membranes. He has found that it is best given in combination with glycerine or mucilage of acacia and with plenty of water.

Climate. Up until about twenty years ago the climatic treatment of *pulmonary tuberculosis* was about all the profession knew concerning

⁵⁰ Indian Medical Gazette, February, 1919.

⁵¹ Journal of the American Medical Association, June 25, 1919.

the management of this disease. Furthermore when the truth began to dawn as to the fallacies regarding climatic treatment those who upheld the belief that tuberculosis could be treated any place were assailed in the most vicious manner. I think the most acrimonious medical debates I have ever listened to were on this subject. In general it is now accepted that climate has little or no influence. It must be admitted, however, that there still remain a few who persist in this fallacy.

Crutcher⁵² has expressed the condition admirably. He states that for any one to believe that any particular region or climate is better suited than any other region or climate to a preponderance of the human family on account of any pathological condition is the utmost folly. For a person in settled business in the East to break up all ties and fly to some desolate, ill-kept boarding house located in some far-away desert, under the pathetic illusion that isolation is a panacea for disease, is such pitiable nonsense that the wonder is that any rational being should be guilty of it. In countless instances the ability to earn bread is fully as important as the power to digest it. Those dependent upon their labor from day to day for the means of living must not suppose that the impossible can be accomplished more readily in one region of the country than in another. Nor must unbounded confidence be placed in the highly colored, and too frequently, misleading reports that emanate from purely interested sources.

The most preposterous absurdities are frequently sent forth by honest but misguided persons who mistake illusions for realities. Many things pleasing to the eye and profitable to the mind bear no relation whatever to the cure of disease. A charming landscape is no substitute for wholesome food, comfortable surroundings, and skilled medical supervision. There is no more a specific for tuberculosis than there is for poverty and old age; and so far as climate alone is concerned it has no more curative effect in this condition than it has in gall-stones or cancer.

It is interesting to recall that this idea was as emphatically stated by Austin Flint nearly half a century ago. In common with many other phases of medicine it serves to illustrate how long it often takes a truth to become accepted.

Creosote. The use of creosote in the treatment of *pneumonia* and *influenza* is favorably reported on by Wells.⁵³ He employs the drug by inunction. For adults, 10 minims of pure creosote are gently rubbed into the right axilla with the finger. If necessary, which Wells found to be rarely the case, a second inunction may be given, this time in the left axilla for fear of blistering. Only slight discomfort attends the treatment; a slight burning of the skin, which passes off in a day or two without vesication, is the only disagreeable effect. For children dilute the creosote with soap liniment, reducing the proportion of creosote according to the age.

Wells treated all of his influenza cases by means of creosote by mouth.

⁵² Medical Record, January 11, 1919.

⁵³ British Medical Journal, April 19, 1919.

Half a minim of creosote was shaken up with half an ounce of water to which was added half a minim of oil of peppermint. This dose was administered three or four times a day. It is a question how much good such a small dose would do.

Diet. ANTISCORBUTICS. During the past year there has been considerable discussion on *scurvy* and antiscorbutics and especially as to whether *scurvy* is to be regarded in the same light as beriberi. McCollum and Pitz have rejected the vitamin hypothesis as an explanation of *scurvy*. They insist that the disease is the outcome of faulty intestinal conditions; that it is not due to any deficiency in the diet, but rather is the result of chronic constipation caused by the physical texture of a *scurvy*-producing diet. They have tried to substantiate this hypothesis by means of animal experiments. Since they promulgated their belief a great deal of study has been directed to the subject. A review of the opinions expressed on the subject indicates that the general belief is opposed to the view expressed by McCollum and Pitz, and nearly all who have studied the problem regard *scurvy* as arising from some food deficiency.

Chick, Hume and Skelton⁵⁴ deny that chronic constipation is a constant accompaniment of guinea-pig *scurvy*. They have shown that modifications in diet, to which no extra laxative effect can be attributed, have cured or prevented the disease and experiments are also described in which the administration of a laxative alone has failed to cure or prevent *scurvy*. So far as experimental *scurvy* is concerned it seems to be reasonably clear that it is due to the deficiency in the diet of a specific food factor of the vitamin type.

In infants, the question of *scurvy* centers about the milk supply. An infant requires fully one pint of fresh raw milk daily to protect it from this disorder. Chick, Hume and Skelton⁵⁵ state that the antiscorbutic property of milk is extremely sensitive to heat and urge that whenever milk is heated in any way, or dried, an additional source of antiscorbutic vitamin should be provided. In their opinion orange-juice is the best substance to use for this purpose. Hess and Unger⁵⁶ state that if the milk is pasteurized, or stale, or heated for a second time, or rendered more sensitive to deterioration by means of an alkali, and particularly if more than one of these influences are operative, more than a pint is needed. They believe that babies fed on pasteurized milk should receive an antiscorbutic from the time they are a few weeks of age, as there is no reason for allowing the negative balance of vitamin to continue for a longer period. A small amount of orange-juice will answer the purpose.

While orange-juice is the antiscorbutic usually employed it is not the only substance available. At one time lime-juice was exclusively employed and also lemon-juice. Hess and Unger⁵⁷ have lately reported some studies with green vegetables. They found that carrots lost much

⁵⁴ Biochemistry Journal, 1918, xii, 31.

⁵⁵ Loc. cit.

⁵⁶ American Journal of Diseases of Children, April, 1919.

⁵⁷ Journal of the Biological Chemistry, June, 1919.

or all of their antiscorbutic potency through cooking. The age of the vegetable also seems to have some influence. Thus there is a marked difference in various lots of carrots, and probably also of other vegetables, according to whether they are fresh and young or are old. It was found, for example, that if, instead of employing the carrots which were ordinarily fed to their laboratory animals, they gave the same amount of fresh young carrots, plucked only a few days previously and cooked, not only did the animals not develop scurvy but they gained steadily in weight for a long period.

In regard to the use of dehydrated vegetables, Hess⁵⁸ states that while they possess a great advantage on account of their small bulk they cannot be considered the hard equivalent of fresh vegetables and unless they are given in conjunction with fresh vegetables, fresh fruit or other antiscorbutic, the dietary will induce scurvy. He states that the same defect that applies to dried vegetables seems to hold in regard to fruits. From personal experience Hess has noted that prunes, which are used so extensively in the dietary of infants, possess practically no antiscorbutic power. He also states that the banana, which would be of great value, on account of its ready preservation throughout the winter, seems to be singularly poor in antiscorbutic power.

A cheap and readily obtained antiscorbutic is the canned tomato. Hess and Unger⁵⁹ have employed strained canned tomatoes in place of orange-juice, in a large number of infants. It is very effective and well borne even by babies a few weeks old.

At a time when oranges are so expensive, and the cost of food has become such a serious item, both for the individual and for institutions, Hess suggests the use of an infusion of orange-peel. This is prepared as follows: The orange-peels are washed, grated, and added to twice their volume of drinking water. This is allowed to stand overnight, then strained and is ready for use. Sugar is added when necessary to make it palatable. Hess has found this infusion most satisfactory. Givens and McClugage⁶⁰ have shown that orange-juice may be preserved by drying. The method is satisfactory, providing the process of drying is not conducted at an unduly high temperature and the duration of drying is very short. The desiccated juice thus obtained retains a significant amount of antiscorbutic potency.

Still another method of using orange-juice is suggested by Hess.⁶¹ He states that orange-juice, boiled and slightly alkalized with normal sodium hydroxid, constitutes an excellent antiscorbutic agent for intravenous use. It can be given in doses of one ounce without occasioning the slightest reaction. He believes this measure is of interest from the standpoint of the pathogenesis of scurvy, and on account of its rapidity of action might be of therapeutic value in combating scurvy in the advanced stage of this disease.

VITAMINS. Although a very considerable amount of work is constantly being done on the so-called accessory food substances but little

⁵⁸ Journal of the American Medical Association, September 21, 1918.

⁵⁹ Loc. cit.

⁶⁰ American Journal of Diseases of Children, July, 1919.

⁶¹ Loc. cit.

real advance has been made. While there can be but little question as to the role played by vitamins in beriberi, scurvy and pellagra, we are not clear as to what their influence is in other conditions. Steenlock⁶² has expressed this uncertainty as follows: "At present it is probably not overstating the situation when it is said that the previously considered all-important attributes of an adequate ration, such as sufficient protein, calories and salts, have probably been slighted by the sudden interest taken in vitamins."

The effect of fresh fruit juice and fresh vegetables on the prevention and cure of scurvy has already been considered.

Commenting on the vitamin content of cereal foods the *Boston Medical and Surgical Journal* for July 18, 1918, points out that it has long been supposed that the cereal foods were particularly poor in vitamins, especially such vitamins as acted to prevent beriberi, pellagra and scurvy. However that may be with respect to pellagra, it now seems certain that the cereals contain an abundant amount of antineuritic vitamin. The vitamin in cereals is contained in the peripheral layers and in the germ. It is lacking in the endosperm. It is the polishing of rice with its removal of the peripheral vitamin-bearing layer that is the cause of *beriberi*. Similarly, the high milling of flour removes not only the peripheral layer, but the kernel as well and causes rapid loss of weight and neuritic symptoms in experiments on fowl.

The distribution of *antiberiberi vitamin* has been investigated by Chick and Hume⁶³ by a study of experimental polyneuritis in birds which is generally accepted as being analogous to human beriberi. Pigeons, if deprived of antiberiberi vitamin (*e. g.*, on an exclusive diet of polished rice or white flour), develop acute polyneuritis or beriberi in fifteen to twenty-five days. The antiberiberi or antineuritic vitamin was found in almost every natural foodstuff examined. The principal source is in the seeds of plants, *e. g.*, cereals and pulses. The most important result emerging from their work is the fact that in cereals the antineuritic vitamin is mainly deposited in the germ or embryo of the grain and to a less extent in the bran. White wheaten flour or polished rice, which consists of the endosperm (minus aleurone layer) of the grain are deficient in this vitamin, and if employed as the sole diet will occasion polyneuritis in pigeons or beriberi in man.

Other important sources of antineuritic vitamin are hen's eggs and fish roe and yeast or yeast extract. Milk and cheese gave disappointing results.

The cereal foods are still the cheapest although valuable foods, and it would be highly undesirable to destroy their value as foods by any artificial process which would deprive them of their vitamin content.

Walshe,⁶⁴ in reporting 40 cases of beriberi, states that it is apparent from all recent experimental work, both in men and poultry, that there are two factors in the production of beriberi: (1) The absence of an accessory food factor or vitamin; (2) the use of certain foods which are

⁶² *Scientific Monthly*, 1918, vii, 179.

⁶³ *Indian Medical Gazette*, June, 1918.

⁶⁴ *Quarterly Journal of Medicine*, July, 1918.

the direct and immediate cause of the disease. He believes that there is considerable weight of evidence to prove that carbohydrates constitute their second direct and immediate factor. Walshe is not satisfied, however, that the clinical and pathological characters of beriberi are compatible with the theory that it is a slowly progressive, diffuse degeneration of the nervous system. The striking symptoms of beriberi and the widespread visceral and nervous changes seen postmortem cannot be accounted for by such a hypothesis. All that can be said at present is that the genesis of the disease may be best expressed by assuming that the use of certain foodstuffs, probably carbohydrates, in the absence of their accessory food factors or vitamins, directly cause beriberi.

A study of the diet of non-pellagrous and of pellagrous households has been made by Goldberger, Wheeler and Sydenstricker.⁶⁵ The indications afforded by their study would seem very clearly to suggest that the pellagra-producing dieting fault is the result of some one or, more probably, of a combination of two or more of the following factors: (1) A physiologically defective protein supply; (2) a low or inadequate supply of fat-soluble vitamin; (3) a low or inadequate supply of water-soluble vitamin, and (4) a defective mineral supply.

The somewhat lower plane of supply, both of energy and of protein of the pellagrous households, though apparently not an essential factor, may, nevertheless, be contributory by favoring the occurrence of a deficiency in intake of some one or more of the essential dietary factors, particularly with diets having only a narrow margin of safety.

The authors state that the pellagra-producing dietary fault may be corrected and the disease prevented by including in the diet an adequate supply of the animal protein foods, particularly milk, including butter and lean meat.

FOOD ANAPHYLAXIS, the method of detecting it and its relation to *skin diseases* is discussed by Strickler.⁶⁶ In making the skin tests, Strickler employed the intradermic method which consists in the introduction of a solution of a food protein in the layers of the skin by means of a hypodermic needle. The amount injected is 0.1 c.c. The following rules are observed in determining a positive reaction: (1) A papule must be present at the point of injection. (2) In the vast majority of cases a zone of erythema is found around the papule. (3) Tenderness is often present at the point of injection. (4) The reaction must persist for more than twenty-four hours after the injection. Strickler's rule was to allow forty-eight hours to elapse before determining the reaction, as by this means, he avoided errors due to traumatism following the injection and also ruled out transient reactions due to any irritant.

In making the tests, the following proteins were employed: Cow casein, egg, beef, mutton, pork, chicken, fish, oysters, clams, crabs, wheat, oatmeal, rice, barley, tomato and strawberries. The protein is extracted by the use of weak alkali, and after shaking and incubating the solution it was filtered, absolute alcohol was added, and the solution

⁶⁵ Journal of the American Medical Association, September 21, 1918.

⁶⁶ Pennsylvania Medical Journal, September, 1918.

evaporated on a water-bath. A saturated solution of this dry material was made in an alkalized sodium chlorid solution.

Strickler concludes that the anaphylactic food tests are of value in the etiological diagnosis and in the treatment of various diseases of the skin. In his experience these reactions find their greatest value in *eczema*, where the development of a strong reaction holds out great hope for an improvement or cure of the disease, and in some instances an amelioration of the associated gastro-intestinal disorder by exclusion of the incriminated article of food.

In chronic urticaria, acne vulgaris and psoriasis the results are disappointing.

The belief has been expressed that an excess of protein has some influence on the production of *psoriasis*. In this connection the following case reported by Pusey⁶⁷ is of interest. The patient, when a child three years old, was thrown into great excitement by seeing a chicken killed, and as a result developed a complete antipathy for animal foods. Until she was nineteen years of age, she ate absolutely no meat, fowl, fish or eggs, except such milk and eggs as she received in breads. For the last four years she has eaten a very small amount of meats, nothing but pork chops and beef and only sparingly of these once a day. She has never eaten eggs, milk, fish, or shellfish. She has tasted milk and eggs but so far as she can recall, she has never tasted fish. Aside from the small intake of animal protein, her diet in other respects is well rounded. Pusey is convinced that her intake of animal protein is a physiological minimum, and she is not a heavy eater of leguminous vegetables, yet she has a clear case of *psoriasis*.

Strickler⁶⁸ studied 11 cases of *psoriasis* by means of the skin tests. Four gave a positive reaction and 7 were entirely negative. In but 1 case was there any improvement in the eruption following an attempt to correct the diet.

THE KARELL CURE FOR HEART DISEASE. Within the past few years interest has been revived in this method of treatment. This plan of treating chronic heart disease was introduced by Karell, a Russian physician, in 1865. He reported 200 patients treated according to the manner which he devised. This consisted in limiting all liquid or food taken by the patient to skimmed milk, which was not allowed to exceed one-half to one glass at equal intervals during the twenty-four hours. The temperature at which the milk was administered varied according to the taste of the patient, but it was forbidden to be taken at a gulp, and orders were given that it should be sipped. If it was found that the patient could take the milk in this way satisfactorily the quantity was gradually increased, until at the end of fourteen days twice this amount was taken.

The exact hours of administration were eight, twelve, four and eight. Constipation, if it ensued, was treated by the use of an enema or by rhubarb or castor oil. In some instances stewed prunes or roasted apples were allowed in the afternoon. In other cases coffee was allowed at

⁶⁷ Journal of Cutaneous Diseases, April, 1919.

⁶⁸ Loc. cit.

breakfast. If thirst became annoying a little water was permitted, and if the man was so overcome by hunger at the end of the second or third week that it was difficult to control him, he was given a little bread with salt or a small piece of herring.

Bullawa⁶⁹ gives the details of the Karell method as employed in several of the hospitals of New York City. Certain modifications used were not included in the original plan. The patient is given 200 c.c. of raw milk, warmed to taste, four times a day at eight, twelve, four and eight for five to seven days. In the next two to six days the diet is augmented by an egg at 10 A.M. and some zwieback at 6 P.M. Later two eggs are given, then vegetables. Gradually rice with milk or tea is substituted for the milk. By the twelfth day the diet has been so increased that the patient receives a full diet with the single restriction that the total fluid intake shall not exceed 800 c.c. in twenty-four hours.

Absolute rest in bed is insisted on, although Karell did not urge this.

After a latent period of from two to three days, and at times more prolonged, during which there has been a slight increase, there occurs a sudden very marked increase in the volume of urine. This may amount to as much as eight or ten times that excreted during the twenty-four hours before the treatment was begun. The marked diuresis continues a varying period, depending on the amount of precedent edema, until all evidence of anasarca or effusion is gone. If the diuresis has been definitely initiated, it does not seem to matter whether the diet, as outlined by Karell, is strictly adhered to or not. The urine continues abundant until the patient has lost from twelve to thirty pounds in weight. This may take one day or several days. There is a marked fall in the blood-pressure, though at times the pressure rises when it has been previously too low. There is always a very great subjective improvement in respect to dizziness, free breathing, sleep and what the patients term clear-headedness. This is frequently manifest before the marked diuresis appears.

The essential feature of the treatment seems to be the reduction of the fluid intake.

Potter⁷⁰ is convinced that in many cases quite as prompt and efficient diuresis, loss of weight, disappearance of edema, and marvelous subjective improvement can be obtained with the modifications he has adopted in following the Karell cure. His plan is as follows: (1) Full milk (unskimmed); (2) strengthening full milk still further by adding cream but without increasing the bulk; (3) by adding lactose in gradually increasing amounts; (4) by adding unsalted and very thoroughly cooked oatmeal in gradually increasing amounts, either to the milk itself as a gruel, or as a cereal on which the milk with or without lactose is found. These modifications if carefully adjusted to the individual taste, digestion and condition, do not disturb but rather aid digestion. Then furthermore, a slower and more agreeable transition to a normal diet, as well as an opportunity to continue such a diet a longer period or practically to renew it from time to time, and that too,

⁶⁹ American Medicine, June, 1918.

⁷⁰ California State Journal of Medicine, January, 1919.

more or less indefinitely whenever an increase of weight or edema or recurrence of dyspnea warns the physician of its expediency. Potter also believes this diet plus the rest entailed accords a valuable introduction to any reduction cure.

Hare⁷¹ believes that this treatment, if tried in cases of cardiorenal dropsy, is indicated only in those cases in which the kidneys are still able to excrete water and salts and in which the pulse is of considerable strength and the arterial pressure is not very low. In cardiac dropsy it may be employed. It may be used in cases of interstitial nephritis but seldom succeeds in chronic parenchymatous nephritis and for this reason he believes its field of usefulness is restricted. When the treatment is successful the results are often remarkable.

Marked myocardial degeneration arising from any cause contraindicates its employment, nor does it seem successful when the liver is engorged. In such cases Hare states that calomel is to be preferred.

DIABETES MELLITUS. In last years' *PROGRESSIVE MEDICINE* I alluded to the employment of the starvation method of treating this disease when complicated by pulmonary tuberculosis. A consideration of this subject will be found in *PROGRESSIVE MEDICINE* for March, 1919, in which the article by Montgomery, Funk and myself⁷² is reviewed.

In considering the prevention and treatment of diabetic coma, Cammidge⁷³ says that the earlier in the course of the disease the patient's tolerance is determined the easier will the diabetes be controlled. The diet should be so arranged that (1) the patient's tolerance for carbohydrate, protein and fat is not exceeded; (2) that the total load of food is within his metabolic capacity; (3) that the diet is correctly balanced, and (4) that a sufficient allowance of inorganic salts is provided.

FOOD POISONING. The term ptomain poisoning is a common one. As generally understood, ptomain poisoning is an attack of acute gastroenteritis which has been caused by the eating of decomposed meat, fish or shellfish. That meat which has undergone putrefactive changes could not be the cause has occurred to many. It is well known, for instance, that the inhabitants of the far north commonly eat and are even said to prefer tainted meat or fish. Again, the eating of "game" ducks, venison, etc., is preferred by many epicures to the fresh meat. Ptomain poisoning rarely, if ever, seems to follow the eating of such foods. On the other hand, as Greenwald⁷⁴ has pointed out, meat of perfectly fresh appearance, taste and odor, but infected with a virulent strain of bacteria, may cause serious illness and death. The relatively simple substances known as ptomain cannot be regarded as responsible for the symptoms observed. They are not sufficiently toxic, particularly when given by mouth. Their existence in any but very badly decomposed meat is open to question.

The rapid development of the symptoms of "meat poisoning" indicates very closely that they are not due entirely to the action of microorganisms within the gastro-intestinal tract.

⁷¹ *Therapeutic Gazette*, June, 1919.

⁷² *American Review of Tuberculosis*, January, 1914.

⁷³ *Lancet*, January 11, 1919.

⁷⁴ *American Journal of Public Health*, August, 1919.

As a matter of fact it is now recognized that meat is not the only cause of *botulism* but that it may also follow the ingestion of canned vegetables and fruits and is produced by the *B. botulinus*. Furthermore, it is now believed that "forage poisoning" in animals is analogous to botulism in man and is due to the toxin of the *B. botulinus* or very closely related bacilli.

Graham and Brueckner⁷⁵ have recovered an organism similar to the *B. botulinus* from corn ensilage which was apparently the cause of an epidemic of "forage poisoning" in cattle. In this case they were able to demonstrate that antibotulinus serum agglutinated the ensilage bacillus and protected animals when injected with the bacillus in otherwise fatal doses, while the serum of animals immunized with the ensilage bacillus, in its turn, had agglutinative and protective effects with respect to the typical botulinus bacillus.

McCaskey⁷⁶ has reported an epidemic in which the injection of anti-botulinus serum, prepared by Graham, was followed by recovery. He urges that the serum should be used early in suspicious food poisoning. The serum, as yet, is not available commercially.

Digitalis. The variability of the strength of digitalis preparations is emphasized by both Pratt⁷⁷ and Wedd.⁷⁸ The former gives in his paper an interesting account of Withering's work on digitalis. It is remarkable that it took nearly one hundred years for the profession to learn how to use digitalis. The method now employed is practically that recommended by Withering. "Let the medicine be continued until it either acts on the kidneys, the stomach, the pulse, or the bowels; let it be stopped upon the first appearance of any one of these effects." Pratt states that failure to obtain results in suitable cases is due (1) to the employment of too small doses and of an insufficient amount of the active drug, and (2) to the use of weak or inert preparations.

As is now known, efficient digitalis leaves can be obtained in this country and there is no reason why the preparation made from the native leaves should not equal the German preparations. According to Pratt it makes no difference in what form digitalis is given, whether as the fresh tincture, or the powdered leaf in capsules or pills, provided an *active* leaf is used. He condemns the infusion as it may upset the stomach and it loses strength rapidly. In regard to dosage he recommends that it be measured in minims or cubic centimeters and not drops. It is a mistake to calculate that 15 drops equals 1 c.c.; it usually takes 35 to 40 drops to make 1 c.c. if an ordinary medicine dropper is used. It can thus be seen that the physician, if he depends on the drop measurement, is not giving the amount of the drug he thinks he is.

The ordinary dose of a strong digitalis preparation is 1 c.c. of the tincture or 0.1 gm. of the powder, three or four times a day. The physiologic effect is usually obtained when 2 to 2.5 gm. of the leaf are taken within from five to seven days.

⁷⁵ Journal of Bacteriology, January, 1916.

⁷⁶ American Journal of the Medical Sciences, July, 1919.

⁷⁷ Journal of the American Medical Association, August 24, 1918.

⁷⁸ Bulletin of the Johns Hopkins Hospital, May, 1919.

Digitalis is indicated in every form of heart failure. The best results are obtained, however, in cases of auricular fibrillation.

In regard to the efficiency of the various digitalis preparations Pratt's observations are important, as he has had a large experience in testing their properties. *German digitalis* is of no use and probably owes its popularity to its cheapness. *French digitalis*, obtained by the method of Homolle, consists chiefly of pure digitalin (digitalinum verum of Kiliani). It is sold in the form of Natavalle's granules; each granule containing $\frac{1}{240}$ grain which is equivalent to $1\frac{1}{2}$ grains of good digitalis leaf. Pratt states that it is trustworthy and deserves more extensive use in this country. *Digalen* he is not favorable to as he has found it to be too weak. *Digipuratum* is an active preparation made from carefully selected leaves. *Digifolin*, a Swiss preparation, is similar to the German digipuratum and equally effective. Pratt warns against the substitution of tincture of strophanthus for tincture of digitalis. The reason for this is the variability and uncertainty of its absorption from the gastro-intestinal tract.

Pratt concludes that much of the digitalis now being used in this country is of poor quality. The active leaf grows in various parts of the United States from Maine to the Pacific Coast. Digitalis from the same locality may vary greatly in strength from year to year. To obtain the full therapeutic effect, the drug should be pushed until it acts on the stomach, the bowels or the pulse, and should then be discontinued for a few days at least.

Wedd also emphasizes the importance of determining the strength of the preparation in use. He believes it to be a perfectly safe procedure and one which will promptly bring about results to begin with an initial dose of 5 c.c. of the tincture and to continue with 8 or 10 c.c. daily until signs of toxicity appear or until clinical improvement warrants discontinuing the drug. In a series of cases studied by him, representing all possible valvular defects, all grades of decompensation, renal lesions of varying degrees of severity, systolic blood-pressures ranging from 90 to 230 and almost all of the recognized types of myocardial involvement, there was not found any clinical entity which might be said to constitute a contra-indication to the use of digitalis.

Christian⁷⁹ is of the opinion that a great deal of nonsense has been written about digitalis especially as to its upsetting the stomach. Many of the pharmaceutical houses appear to have tried to prepare non-nauseating preparations of digitalis, and while most of these preparations do not produce nausea it is because they are weak preparations. Christian also considers the fad of fat-free digitalis an excellent example of wasted effort. He prefers the powdered leaf made freshly into pills. The digitalis should be prescribed in weighed or measured amount and enough of a reliable preparation should be given to produce a definite effect at least within four days; usually an effect is noted to begin in half this time.

In Christian's experience, digitalis produces most excellent results in chronic myocarditis and there are no contra-indications to its use,

⁷⁹ American Journal of the Medical Sciences, May, 1919.

and even in those cases advanced beyond the bounds of a therapeutic response no bad effects follow the use of the drug.

His observation confirms the findings of Mackenzie and Cohn and Frazer that the drug rarely slows the pulse, except in auricular fibrillation, until toxic symptoms are produced.

Sutherland⁸⁰ has studied the action of digitalis on the rapid, regular, rheumatic heart. He is convinced that the drug can be used with as much confidence in its efficient and beneficial action as in cases of auricular fibrillation. In the rapid regular heart, the digitalis is given with a view to its acting on the sino-auricular node, while in the latter its action is directed to the auriculoventricular node and bundle. In both cases, a slowing of the ventricular rate is aimed at and provided that there is a sufficiency of sound muscle in the ventricles, the natural powers of the heart are capable of restoring a weakened or failing circulation.

Satterthwaite⁸¹ expresses a strong preference for the glucosides. He believes that digipuratum, digifoline and digitol are more reliable than the galenicals.

In regard to the employment of digitalis, no matter what preparation is used, Satterthwaite states that one should not be afraid to give it in sufficient quantity to get the desired therapeutic action. He believes that when a prompt action is desired, as in heart failure from edema or temporary congestion of the lungs, the preferable preparation is a glucoside like digipuratum, if it can be obtained, using it by deep intramuscular injection. The response occurs within an hour and its action is continued for six or more hours, after which other forms of digitalis may be given orally. A good substitute for the digipuratum is digalen. As prepared for hypodermic use, digalen is said to consist of an amorphous digitoxin, soluble in water, to which $7\frac{1}{2}$ per cent. of alcohol is added, with a little glycerine.

Epinephrin (Adrenalin). Notwithstanding the fact that epinephrin, so called, does not exist on the market, and is never used for medicinal or experimental purposes, certain writers persist in employing this term when they have actually used adrenalin, although adrenalin is the official name in the British Pharmacopœia. As the term epinephrin is used to designate a somewhat different and unobtainable substance the term should be dropped. Auer and Meltzer⁸² have studied the effect of intraspinal injections of adrenalin. In monkeys 1 c.c. or 1.5 c.c. of adrenalin in the lumbar region causes a rise of blood-pressure distinctly different in character from the curve obtained after intravenous injection. The rise of blood-pressure following an intraspinal injection is generally characterized by a slow rise from the original level to the maximum height, then by a plateau-like duration of the maximum and finally by a slow fall of the pressure to the level which prevailed before the injection of the adrenalin.

A more lasting effect is produced by the intralumbar injection than

⁸⁰ Quarterly Journal of Medicine, April, 1919.

⁸¹ International Clinics, 1919, series 29, vol. iii.

⁸² American Journal of Physiology, December, 1918.

by the intravenous route. As a rule, when the pressure falls it does not go below the level observed prior to the injection.

McGuigan and Hyatt⁸³ have studied the effects produced on the blood-pressure by the intravenous injection of adrenalin in dogs. The injection of 0.5 to 1 c.c. of a 1 to 10,000 solution causes a quick rise in the pressure followed by a rapid fall and a secondary rise. According to McGuigan and Hyatt, the cause of the secondary rise is apparently due to a central action of the adrenalin acting through the sympathetic ganglia. They base this belief on the fact that removal of the head or pithing of the brain prevents the occurrence of this phenomenon. Also paralysis of the ganglia with nicotine prevents it. On the other hand, the secondary rise occurs after sectioning of the vagi and the administration of atropine or pilocarpine.

In a study of the action of adrenalin on the digestive tract, Binet⁸⁴ believes that adrenalin has an undoubted modifying action on the vascularization, secretions and motor functioning of the digestive tract. Introduced directly into the stomach, it does not seem to exert any toxic effect. On the other hand, if introduced into the rectum, it proves very toxic in doses similar to those that are lethal for the animals when injected subcutaneously. He ascribes this to the close anastomosis between the hemorrhoidal veins and the portal vein, the liver being apparently the barrier which arrests the adrenalin when ingested.

Lesné reported, in 1912, that when adrenalin was injected into the rectum of rabbits the animals died, but not so rapidly as when the same dose was injected subcutaneously. The same dose introduced into the stomach or small intestine seemed entirely harmless.

In regard to the toxicity of adrenalin Binet recalls the case reported by Grasset in which 35 gm. of a 1 to 1000 solution of adrenalin was swallowed with suicidal intent, without appreciable results.

In a study of the effect of adrenalin on muscular fatigue, Gruber and Kretschmer⁸⁵ found that 0.5 to 1 c.c. of a 1 to 1000 solution counteracts the induced fatigue produced by the perfusion of fatigue substances, such as sarcocollactic acid, lactic acid, and acid potassium phosphate through the muscle in identically the same way as it does the fatigue produced normally in active muscles. In some cases the adrenalin has no bettering effect.

In children Galvani⁸⁶ has found that adrenalin has a general toxic and antitoxic action as well as its direct vasoconstricting effect. He believes that the soft and elastic arteries in children and the integrity of the cardiovascular and other systems render adrenalin peculiarly effectual. Except in very urgent conditions administration by mouth is preferable. This is harmless and obviates abrupt changes in the circulation. The dose is from 10 to 30 drops of a 1 to 1000 solution. When an especially prompt action is desired it may be injected subcutaneously in doses of from 0.5 to 1 c.c.

⁸³ *Journal of Pharmacology and Experimental Therapeutics*, September, 1918.

⁸⁴ *Presse méd.*, August 1, 1918.

⁸⁵ *American Journal of Physiology*, November, 1918.

⁸⁶ *Revista di clinica pediatrica*, May, 1918; abstract, *Journal of the American Medical Association*, August 31, 1918.

Injections of small doses of adrenalin have been employed of late to determine the presence of *hyperthyroidism*. Nicholson and Goetsch⁸⁷ have employed the test to differentiate certain cases of hyperthyroidism from early tuberculosis. They employed a subcutaneous injection of 7.5 minims of a 1 to 1000 solution. If the patient reacts positively there is an increase in the blood-pressure, tachycardia and the restoration of, or the development of, the signs and symptoms commonly associated with hyperthyroidism. They applied the test in eighteen patients in whom the diagnosis was "clinical tuberculosis, inactive." Of this number 10 reacted positively and 7 negatively, and of 6 with active clinical tuberculosis, none reacted positively. They conclude that the test is a valuable aid in determining whether the disease from which patients are suffering is purely a tuberculous infection, a tuberculosis complicated by hyperthyroidism or hyperthyroidism alone. When the latter is present, either alone or in association with tuberculosis, a positive reaction always occurs. The test should be of value as there are certain cases in which the evidences of hyperthyroidism are not clear and in which the symptom-complex is mistaken for early tuberculosis.

Bernard⁸⁸ has found the test valuable in bringing to light dubious cases of *exophthalmic goitre* in which the cardinal signs are absent. He has found at operation that such cases often reveal the presence of small adenomas in the thyroid. The subsidence of all the symptoms afterward confirms the assumption of the causal hyperthyroidism. Bernard emphasizes the importance of recognizing this group of cases in which the excessive functioning of the thyroid is responsible for conditions labeled psychoneuroses, psychasthenia and neurasthenia, without there being appreciable ocular, vasomotor or cardiac symptoms.

Barreiro⁸⁹ believes that the function of the adrenal glands is markedly interfered with in *typhoid fever* and that the administration of adrenalin is logical and in the tropics is especially serviceable. He reports extraordinary improvement in the general condition from the use of 3 drops of a 1 to 1000 solution given by mouth two or three times a day. At times the injection of 0.5 c.c. is of benefit in reducing the pulse-rate.

In the treatment of *viper poisoning*, Coffin⁹⁰ states that the treatment now recommended in India consists of the intravenous injection of Bayliss' fluid (gum Arabic, 7 parts; sodium chloride, 0.9 part; water, 92.1 parts); the injection of ardenalin; and the intramuscular injection of 1 gm. of calcium chloride with 20 minims of water. This treatment is not meant to supersede the use of antivenene but as an adjunct to cases known to be due to Russell's viper or of dubious origin. It should, in Coffin's opinion, be of great value in cases of Echis poisoning, there being no available antivenene for the treatment of these cases.

Ethylhydrocuprein (Optochin). The use of this drug in the treatment of pneumonia has been commented on in previous issues of PROGRESSIVE MEDICINE. It is to be borne in mind that its use is dangerous and that

⁸⁷ American Review of Tuberculosis, April, 1919.

⁸⁸ Progrès médicale, May 10, 1919.

⁸⁹ Abstract, Journal of the American Medical Association, August 2, 1919, p. 364.

⁹⁰ Indian Medical Gazette, June, 1919.

furthermore it is useless in the routine treatment of pneumonia. Lewis,⁹¹ in an experimental study of the effect of continuous intravenous injections of the drug on experimental pneumococcus infections of rabbits, concludes that the effect of a fatal dose of pneumococcus on rabbits is not affected by this method, in spite of the fact that the animal's blood may be distinctly bactericidal *in vitro*. He believes that the failure of this method is probably due to the nature of the drug and not to the method.

Iodine. Within the past few years more than usual attention has been given the teeth and gums. It is now a common practice to have the teeth x-rayed and, largely on the judgment of the roentgenologist, a large number of teeth have been extracted.

Edgelow⁹² calls attention to the quite unnecessary vigor with which *acute septic gingivitis* is often treated by wholesale extractions of teeth. He has found this condition a very tractable one to deal with if properly treated.

The routine treatment he has found efficacious is as follows: After thoroughly rinsing the mouth with an iodine wash he applies tiny pellets of wool soaked in equal parts of camphor and phenol well up into each interdental gingival space for a few minutes. This quickly relieves the pain produced by any instrumentation. A fresh paste made by mixing equal parts of thymol, dried alum, and oxide of zinc with the oily camphor-phenol mixture is then carefully packed into the gingival spaces and around the necks of the teeth beneath the edges of the gum and allowed to remain there. A simple mouth wash is directed to be used after food, and the tooth-brush is forbidden during the treatment. He applies the paste every other day for ten days or so. After the second or third application there is a decided amelioration of the symptoms, namely, sleeplessness, pain, bleeding and malodor. When the disease has been controlled and the gums are returning to a healthy condition, a simple astringent wash of alum and phenol is all that is necessary to complete the cure.

As a preventive to its recurrence Edgelow directs the patient to paint the gums every other day with the simple tincture of iodine, and to be particularly careful in maintaining a sanitary condition of the tooth-brush.

Taylor and Austin⁹³ have made an experimental study of a variety of antiseptics, among them iodine. They conclude that inasmuch as experienced surgeons do not approve of the injection of solutions of iodine and phenol into closed cavities, it would seem advisable not to use any of the antiseptics studied by them as all exhibit a greater toxicity for mice and guinea-pigs than iodine and phenol.

The treatment of *leucorrhea* is so unsatisfactory that any suggestion in the management of this condition is welcome. Radcliffe⁹⁴ recommends for this purpose a "00" capsule filled with powdered boric acid to

⁹¹ Archives of Internal Medicine, November, 1918.

⁹² British Medical Journal, July 27, 1918.

⁹³ Journal of Experimental Medicine, May, 1918.

⁹⁴ Therapeutic Gazette, July, 1919, p. 532.

which is added some tincture of iodine. A capsule is introduced into the vagina at night. The capsule may be expelled, swollen but not dissolved. This can be overcome by making a few pinholes in the ends and sides of the capsule.

Ipecac. Many years ago ipecac was used in the treatment of certain types of *dysentery* before it was recognized that the ameba was the causative agent. The treatment fell into disuse and became forgotten. This may be ascribed largely to the fact that the heroic doses employed often caused marked prostration; furthermore it was often necessary to administer large doses of opium in order that the ipecac would not be vomited.

When the active principle of ipecac became known there was a revival of the treatment. The studies of Vedder and Rogers on the effect of *emetine* almost at once gave the drug a world-wide prominence in the treatment of amebic dysentery. As the drug became more and more used it became apparent, however, that emetine was apt to cause a good deal of circulatory depression and in not a few instances death has been attributed to the hypodermic dose of the drug. In addition to its effect on the heart, emetine often produces marked gastro-intestinal irritation even when given hypodermically and may also produce a peripheral neuritis. Furthermore, it is becoming more and more recognized that the results obtained from the hypodermic use of emetine are not as permanent as was at first believed.

The type of case in which emetine fails is that in which the amebæ are encysted. Such cases while apparently cured, continue to harbor the amebæ so that the patient continues to be a carrier and distributor of the disease. It is in this type of case that ipecac itself, given in proper doses, is most efficient.

At present there is a reaction in favor of returning to ipecac rather than using its active principle emetine.

Simon⁹⁵ believes that the objection to emetine, as stated above, makes a return to the use of the original crude ipecac root highly advisable. That the old method has failed to succeed in the past he believes to be due to the fact that the details of the treatment have not been properly carried out. First of all he insists that the patient be put to bed for the full course of the treatment, extending ordinarily over a period of ten days, and also that the dietary be restricted in the beginning to articles of food which leave no residue in the intestinal tract, such as broths, whey, albumen water and the various nutrient alcoholic preparations. In this list, milk is to be added only after the fifth or sixth day of treatment.

In beginning the treatment a dose of castor oil should be administered on the morning of the first day. That evening, about 9 o'clock, from ten to fifteen salol-coated pills, each containing 5 grains of powdered ipecac, should be given. (The pills require a certain amount of skill in the making. They cannot be produced in bulk by the pharmaceutical houses, because of the fully demonstrated lack of durability of the

⁹⁵ Journal of the American Medical Association, December 21, 1918.

product. They must be made by the individual druggist and dispensed in quantities sufficient only for the individual case.) The patient is instructed to swallow the pills slowly with the aid of moderate amounts of water. No nourishment should be given for ten hours preceding and likewise for six hours following the administration of the pills.

Each succeeding night the same plan is to be repeated. It may be found necessary, especially in the presence of any depressing effect to discontinue the use of the pills for a one-night period. Each day the attending nurse keeps a record of any pills which have passed undissolved in the stool, with the idea of determining the total amount of ipecac retained at any stage of the treatment.

The complete dosage includes the retention of at least 100 pills, equivalent to 500 grains of the powdered ipecac. This is accomplished usually within a period of ten days and only under rare conditions must be made to extend over ten weeks. Should nausea and vomiting arise as troublesome features, an extra enteric coating should be added to the pills. Simon has found that a coating of one-tenth of an inch of salol is ample. In some instances, the reason for which is not clear, large numbers of the pills will pass through the intestinal tract intact. He has adopted the plan, in such cases, of making one or two small punctures into the outer layers of the pill surface, with a small-sized surgical needle. Rarely the patient cannot tolerate the ipecac in pill form. In such cases the drug may be given by the duodenal intubation method, employing for the purpose daily instillations of 30 grains of the powdered ipecac suspended in water. In this connection it may be stated that Lawson⁹⁶ advises the use of ipecac by way of the rectum. It will be recalled that Brem and Zailer had previously employed this method in several cases which had not yielded to other methods of treatment. Lawson's plan is to put 60 or even 120 grains of powdered ipecac into about 24 ounces of water; this is kept hot for an hour, but not allowed to boil. After washing out the bowel with warm water, this whole preparation without filtering is given slowly by rectum and retained as long as possible. If there is much pain and tenesmus, only a part of this can be given. This method may be employed alone or in association with ipecac by mouth or emetine hypodermically.

Freund, in discussing Simon's paper, employs wine of ipecac through the duodenal tube. He passes the tube when the stomach is empty and then injects the wine of ipecac, beginning the first day with 1 ounce the next day 2 and so on. He has given as high as 6 ounces in one instillation. At the end of three days he gives a small dose of opium in some form to quiet the patient and produce constipation for two or three days. Freund observes the rules as to rest and diet, as recommended by Simon.

Simon concludes that the crude ipecac root in doses sufficient completely to destroy the infecting organisms is never toxic. Both emetine and cephalin frequently exhibit toxic properties in an average dosage of from 0.5 to 1 grain daily over a limited period; furthermore, they

⁹⁶ Journal of the American Medical Association, September 28, 1918.

are ineffective within safe limits of dosage in destroying the encysted forms of *Entameba histolytica*. The entire root, on the other hand, when employed under proper conditions, not only destroys the vegetative endameba but the encysted forms as well, and thereby prevents recurrences or relapses of the infection.

The use of *emetine* for the control of hemorrhage has been recommended from time to time. Monro⁹⁷ records a case of *hemophilia* in which remarkable results were obtained. He administered $\frac{1}{2}$ grain of emetine hydrochloride by hypodermic injection in the forearm. The next morning the patient was in a profuse perspiration, complained of pain in the joints; the arm was swollen. The urine was scanty and still bloody; the temperature had fallen to 100°. The following day the temperature was normal, the joints better and the urine normally colored, the first for exactly ten weeks. From this time the patient had an uninterrupted recovery.

Bishop⁹⁸ has found that *ipecacuanha* is a valuable adjunct to digitalis in disorders of the auricle. He prescribes $\frac{1}{2}$ grain of powdered digitalis and $\frac{1}{8}$ grain of powdered *ipecacuanha*. The use of the latter does not increase the tendency to nausea and the effect of the digitalis seems to be improved. In cases of *auricular fibrillation* with a rapid and irregular pulse, Bishop prescribes powdered *digipuratum*, gr. xviii, and powdered *ipecac*, gr. v, made into twelve powders. The powder is given every four hours until four are taken; one every six hours until four are taken; and one every eight hours until four are taken.

Magnesium Sulphate. The use of solution of magnesium sulphate in the treatment of *acute inflammatory conditions* has been followed for some years. This method of treatment has been especially useful in dealing with *erysipelas*. Meltzer⁹⁹ has experimented with solutions of magnesium sulphate in the treatment of scalds in animals. He has also had occasion to note the effect of the drug in cases of *burns* in human beings. First and second degree burns were invariably arrested in their development when molecular solutions of magnesium sulphate were applied early. Third degree burns, as a rule, ran a more favorable course under the application of magnesium sulphate than under any other treatment. Higher concentrations than 25 per cent. seem to exert a still better influence. A favorable action in advanced stages of burns of second and third degrees is less striking, especially if infection is present; but even in these cases there is a favorable action. Meltzer suggests that in these cases the magnesium sulphate might be used alternately with antiseptics.

Some years ago a saturated solution of magnesium sulphate was recommended by Tucker in the treatment of *erysipelas*. Since that time it has been used in a variety of acute inflammatory conditions. Northrup¹⁰⁰ states that for a long time women have known that a saturated solution of magnesium sulphate may be used as a substitute for

⁹⁷ Practitioner, September, 1918.

⁹⁸ Medical Record, August 31, 1918.

⁹⁹ Journal of Pharmacology and Experimental Therapeutics, November, 1918.

¹⁰⁰ Journal of Infectious Diseases, February, 1919.

talcum or face powder, and that a small amount of this liquid taken in the palm of the hand and rubbed over the face until dry leaves a "bloom" upon the skin, and that if there is a tendency to pimples these dry up and disappear. Acting on this suggestion, Northrup investigated the influence of magnesium sulphate on the organism commonly associated with pimples, namely, the *Staphylococcus aureus*. His investigation seemed to show that the salt does possess distinct antiseptic power not only in regard to the *staphylococcus*, but also that it inhibits the growth of the *streptococcus* in the skin.

Mercury. The relative efficiency of mercurial preparations in *congenital syphilis* in infants and children has been investigated by Roussey and Ziegler.¹⁰¹ When mercurial ointment is placed in contact with the skin, without any friction being used (protected and sealed by wax paper from being volatilized and inhaled), it is taken up by the skin and excreted in the urine and continues to be excreted in the urine for a variable time after all treatment has been discontinued. By rubbing the mercurial ointment into the skin, it is readily taken up and eliminated in the urine and continues to be eliminated for a considerable time. When one inunction is given, the maximum daily amount of mercury is usually eliminated during the following twenty-four hours. If the inunctions are given continuously, the mercury accumulates in the system and considerable amounts are eliminated at intervals with only traces between. While they believe that these results show that it is unnecessary to have mercury in contact with the skin, either with or without rubbing, as long as has been generally thought necessary, further studies are necessary in order to definitely establish this fact.

They also found that salicylate of mercury suspended in oil and given subcutaneously was eliminated in the urine for eight days or longer. This would indicate that the dose need not be repeated oftener than once in eight days. The same is true of mercuric chloride given intramuscularly.

In the treatment of certain types of nervous syphilis, Grinker¹⁰² often resorts to inunctions of mercury. Although a number of substitutes have recently been introduced he believes that "blue ointment" is still the most effective. Owing to the fact that it is a dirty preparation, Grinker in private practice uses the *oleate of mercury* in the same doses as the mercurial ointment. According to Jelliffe, it is well to begin the use of the oleate with 1 dram each night and morning, until the first evidences of salivation have appeared; then the dose is reduced to 1 dram nightly. The oleate of mercury is rubbed into the skin by means of a piece of flannel, selecting a different part of the body for each administration, the same as for mercurial ointment.

Calomel (0.016 gram every two hours for four doses) and *gray powder* (0.03 gram every three hours for three doses) continue to be eliminated in appreciable amounts in the urine for as long as nine days; the maximum daily elimination usually occurred during the

¹⁰¹ American Journal of Diseases of Children, November, 1918.

¹⁰² International Clinics, 1919, series 29, vol. iii.

twenty-four hours following administration. It is therefore probable that the daily use of any of the mercurial salts in the amounts usually prescribed is unnecessary and presumably harmful.

The treatment of *puerperal septicemia* by means of *intravenous injections of mercuric chloride* is advocated by Pérez.¹⁰³ He employs a 1 to 1000 solution of the mercuric chloride, giving 2 c.c. the first day, half in the morning and half at night; the second day 4 c.c., fractioned, and so on up to 10 c.c. the fifth day, continuing with this dose until the fever drops, then keeping on with half the dose. The treatment is most effective in septicemia. It is contra-indicated in fulminating cases as the organism does not have time to react, and also in pyemia. No untoward by-effects have been noted.

Pérez states that he has treated 200 cases of puerperal septicemia in this way. In the present era of cleanliness in surgical and obstetrical practice this seems like an extraordinarily large number of cases of this condition. It would seem that the use of the mercuric chloride as a preventive would be more to the point.

The dose of *calomel* varies greatly in different parts of the country. In some portions of the United States, notably the South, extremely large doses of the drug is the rule; 5 to 10 grains, or even more, are administered at one dose. During my internship at the Philadelphia General Hospital the administration of 5 grains of calomel was a routine practice. At that time I gave it without a thought and never saw any untoward effects. Later, when I entered private practice, I hesitated to use these large doses and so far as I can recall have never employed them in the case of a private patient. I think throughout the North there is a fear of employing the drug in large doses, the prevalent method being the administration of $\frac{1}{10}$ of a grain every ten or fifteen minutes until a grain is taken. Hare¹⁰⁴ states that when large doses of calomel are necessary the use of a saline purge within twenty-four hours is a wise precaution which should not be overlooked; as, unless the mercury is swept out of the intestine by such means, sufficient mercury may be retained and absorbed to produce evidences of ptyalism. This is especially true in localities where the liver is torpid and resistant to the drug. In the North, doses of 1 or 2 grains of calomel may be given at intervals, often without being followed by a more active purge, with success as to hepatic function and without any danger of ptyalism.

The use of calomel in the treatment of *pruritus ani* has been recommended by Hamburger.¹⁰⁵ Dry calomel should be rubbed into the affected part. When it is rubbed in well it sticks until the next day. He emphasizes the fact that in salve form it cannot be counted on for effective results. The treatment of *chronic malaria* with enlargement of the spleen by means of intravenous injections of mercuric

¹⁰³ Medicina Ibero, August 10, 1918; Journal of the American Medical Association, January 18, 1919.

¹⁰⁴ Therapeutic Gazette, 1919.

¹⁰⁵ Ugesk. f. Læger, August 15, 1918; Journal of the American Medical Association, October 26, 1918.

chloride in combination with quinine is considered in the *British Medical Journal* for September 14, 1918. It is recalled that N. Barlow, in 1916, noted that this method caused a very rapid reduction in the size of the spleen. The plan has been tested by Grieg and Ritchie, by taking 54 control cases on 30 grains of quinine in three oral doses early, and 50 cases treated in the same way as regards quinine, but in addition, by intravenous injection, on alternate days for eight injections, of 11 c.c. of a solution of mercuric chloride, 1 to 1000 in saline. As complications of the injections salivation was noted in 2 cases, slight phlebitis in 3 or 4, diarrhea in 5, and 2 cases had febrile relapses and temporary splenic enlargement while under treatment.

Although Grieg and Ritchie did not fully confirm Barlow's observations, their experience seemed to show that the combined treatment had a greater effect in reducing the size of the spleen than quinine alone had. Under quinine alone the treatment failed in 16 cases, while under the combined treatment failure occurred in 7 only. They therefore feel that in this type of case that the treatment is to be recommended.

As in other conditions in which mercury is employed, it is essential to know the status of the kidney. If the functional capacity of the kidneys is impaired, the treatment should not be given.

It is evident that the frequent warnings as to the danger of dispensing bichloride tablets to lay people without a prescription are bearing fruit. The literature of the past year has not recorded any cases of poisoning from this source which is in marked contrast to the state of affairs which existed up to a year or two ago. A rather unusual form of *mercurial poisoning* is reported by Hammer.¹⁰⁶ He injected 1 c.c. of a 1 per cent. solution of mercuric chloride, fractioned, into a much enlarged and ulcerated vein in the leg. The patient was a robust woman aged thirty-six years. Vomiting and diarrhea followed in an hour and a half, with anemia, edema and fatal collapse on the twelfth day. The drug was injected in the hope of inducing immediate coagulation in the vein and thus obstructing it.

Weiss¹⁰⁷ who has previously written on the subject of the treatment of *mercuric chloride poisoning* now reports on 54 consecutive cases with but 3 deaths. Of the 3 patients who died, 2 received the treatment only after unavoidable delay, and 1 had a preëxisting nephritis and cirrhosis. The essential features of the treatment proposed by Weiss consists of an early washing out of the mercury salt from the stomach and intestine and the continued introduction of sufficient alkali to overcome the acid intoxication. It is essential that there be no delay in beginning the treatment, as the longer the interval between the ingestion of the poison and the institution of treatment, the more uncertain are the results.

Weiss begins the treatment by washing out the stomach with a mixture of 1 quart of milk and the whites of three eggs, following this by a saturated solution of sodium bicarbonate until the stomach wash-

¹⁰⁶ Deutsch. med. Wchnschr., January 9, 1919.

¹⁰⁷ Journal of the American Medical Association, September 28, 1918.

ings return clear. Finally, before the stomach-tube is removed, from 3 to 4 ounces of crystallized magnesium sulphate in from 6 to 8 ounces of water are allowed to remain in the stomach. A soapsuds enema is then given. As a rule the patient vomits shortly after taking the mercury, thereby aiding in the elimination of the poisons.

The next step is to introduce alkali. This he gives by mouth, rectum and intravenously. As soon as possible after washing the stomach, the patient is given Fischer's solution intravenously. This solution consists of crystallized sodium carbonate, 10 grams, or 4.2 grams of the ordinary "dry" salt; sodium chloride, 15 grams, and distilled water, 1000 c.c. From 1000 to 2000 c.c. of this solution are given as a first dose. This alkaline medication is reinforced by giving 8 ounces of "imperial drink" every two hours. The latter consists of:

Potassium bitartrate (cream of tartar)	3j
Sodium citrate	5ss
Sugar	5ss
Water	3viij

This is flavored with orange- or lemon-juice. There are no restrictions in diet at any time during the treatment.

Weiss states that the scarcity of the acid intoxication and the amount of alkali and salt that needs to be given is determined by analysis of the urine. Except in the suppression cases the patient voids large quantities of urine, the amount depending on the fluid intake. The urine should become alkaline to methyl red (a saturated solution of methyl red in alcohol) and be kept so. Fischer has demonstrated that if the urine of a nephritic cannot be maintained alkaline to methyl red, the patient continues in a serious state. If the output of urine is not seen to be maintained, and if its reaction does not become alkaline to methyl red after the first intravenous injection, a second intravenous injection is given the following day, and general alkali administration by mouth or rectum is continued.

In spite of the severe reaction in the kidneys, it is interesting to note that Weiss found that in the cases that were treated early there was only a slight or no diminution in the phenolsulphonaphthalein output; and, when diminished, it rapidly rose to normal and continued so. In one patient who developed anuria for three days, the phenolsulphonaphthalein output was practically zero for five days after he commenced to excrete urine, and then rapidly rose to 66 per cent. at the end of thirty-three days. This patient's urine was normal six months after recovery from the mercuric chloride poisoning. In last year's PROGRESSIVE MEDICINE reference was made to a case of severe mercuric chloride poisoning in which the examination of the urine a year later showed it to be normal.

A method of treatment which embodies the same principles as those laid down by Weiss but which differs slightly as to detail is that recommended by Rosenbloom.¹⁰⁸ The successive steps in this plan are as follows:

¹⁰⁸ American Journal of the Medical Sciences, March, 1919.

1. Administer the whites of three eggs beaten up in a quart of milk and then empty the stomach by siphonage.
2. Give 300 c.c. of fresh calcium sulphide solution, containing 1 grain to 1 ounce of water, by mouth.
3. Wash out the stomach with fresh calcium sulphide solution, 1 grain to 1 ounce of water.
4. Administer in powder or tablet 0.36 gram of sodium phosphite and 0.24 gram of sodium acetate. If this is not available give the following may be given:

Sodium hypophosphite	1 gram
Water	10 mls
Hydrogen peroxide	5 mls

Use ten times as much of the hypophosphite as poison taken. Give a copious lavage of stomach with the above antidote diluted twenty times. Give the above undiluted antidote every eight hours for two days.

5. After the above lavage pour through the stomach-tube a solution of 3 ounces of sodium sulphate and 6 ounces of water containing 5 grains of calcium sulphide. Let these solutions remain in the stomach.
6. Give intravenously, after withdrawing 600 c.c. of blood, 800 c.c. of Fischer's solution or of bicarbonate-glucose solution.
7. Wash out the stomach morning and night, giving by the mouth after each washing 5 grains of calcium sulphide dissolved in 3 ounces of water. Continue this lavage until the stomach washings are free from mercury when tested by Elliott's method and until the urine is free from mercury.
8. Give high colon irrigation of warm water morning and night, using 8 gallons of the water for each treatment.
9. Give a hot pack twice daily.
10. Give 8 ounces of milk every second hour.
11. Give every second hour 8 ounces of the following solution, alternating with the milk:

Potassium bitartrate	5j
Sodium citrate	5j
Sucrose	5j
Lactose	5iv
Lemon juice	5j
Boiled water	3xvj

12. Force the patient to drink large quantities of the alkaline water, such as Celestins Vichy or Kalak water.
13. Give a low fat and a low protein and a high carbohydrate diet for four weeks; avoid salt in the food, as it increases the absorption of the mercury.
14. Give by continuous proctolysis a solution containing 1 dram of glucose, and 3 drams of sodium bicarbonate to the pint.
15. Keep the urine alkaline to methyl red.
16. Continue rest treatment until recovery, usually a period of three weeks.

Mineral Oil. Liquid paraffin or mineral has now firmly established itself as one of the best laxatives we possess. It is especially useful in cases of intestinal stasis. Obstetricians are also finding it of the greatest service in pregnancy. So far as I know, no harm can follow its use. This is certainly true of the oils of American make. It is possible, however, than an impure oil might cause trouble. This is indicated in a report in one of the Danish journals. Bjerrum¹⁰⁹ states that, while liquid paraffin and petrolatum are harmless, petroleum (kerosene?) is often toxic for children. Chrom, in commenting on Bjerrum's experience, states that Straume advises against the use of liquid paraffin and petrolatum as he was able experimentally to produce marked untoward symptoms and even death in cats from the use of the oil. Another observer, however, stated that he had never seen any untoward results occur when the American oils were used.

In considering the treatment of *intestinal stasis*, Sadler¹¹⁰ states that he has discarded all other forms of laxatives and cathartics, except in the early days of a course of treatment, when he sometimes uses cascara. Mineral oil is not a laxative but a lubricant and in Sadler's experience, agrees with 19 out of 20 patients. The paraffin substances, used either in liquid or solid form (and from the standpoint of efficiency there is little to choose between any of the preparations), may be given before meals in doses of from one to four tablespoonfuls.

Opium. The value of the use of opium in the treatment of *heart disease* is emphasized by Laubry and Esmein.¹¹¹ In their opinion there is no need to fear that the use of *morphine* will interfere with elimination. They agree with Vaquez that the injection of 0.01 or 0.02 gram of morphine is the best means to remedy the sudden danger which results from an attack of acute edema of the lungs. Whatever the cause of acute pulmonary edema, they state that there occurs a sudden vasodilating excitation of the vessels of the lungs. In this sudden upset of the vasomotor balance, entailing a sudden, profuse bronchopulmonary secretion, obstructing the air passages, they urge the utilization of the drug which has instantaneous sedative action on the vasomotor and secretory centers. The fear of morphine in these cases is that it may interfere with some of the secretory organs, especially the kidneys, and then increase the patient's danger. Under these circumstances they combine venesection with the use of the morphine but in some cases of recurring pulmonary edema with aortic disease of different kinds, the morphine alone had proved as effectual as when associated with venesection, when conditions prevented the use of the latter. They have also had favorable results from the use of morphine in a case of sudden pulmonary edema due to high blood-pressure and advanced kidney disease. In cases of albuminuria with high blood-pressure and scanty urine, the attacks of dyspnea have subsided under the use of morphine, the pulmonary and renal symptoms

¹⁰⁹ Ugeskrift for Læger, June 20, 1918; Journal of the American Medical Association, September 7, 1919, p. 862.

¹¹⁰ Illinois Medical Journal, February, 1919.

¹¹¹ Paris médicale, September 28, 1916.

disappearing together as a flood of urine was voided. In cases of permanent high tension, caution is necessary, but these cases are often relieved of their continuous dyspnea and insomnia by the use of 0.2 gram of Dover's powder and 0.1 gram of digitalis powder.

Paroxysmal tachycardia may also be relieved by the opiate when the pain and distress resembles those of angina pectoris.

Among the formulas recommended is one in which 0.02 gram each of caffeine and pulverized opium are mixed with 0.2 gram each of quinine sulphate and antipyrine. A cachet of this may be ordered every three hours, thus keeping the patient under the influence of mild opium medication for several days.

To avoid attacks of pain, when instantaneous action is not imperative, they combine the morphine with a rapidly diffusible vasomotor drug, trinitrin. The formula employed for this purpose consists of morphine hydrochloride, 0.06 gram; an alcoholic solution of trinitrin (1 per cent.), 60 drops; distilled cherry laurel water, 20 grams and distilled water enough to make 100 grams. Two or three teaspoonfuls of this mixture may be given during the day.

Pertonal (Acetyl-amido-ethoxy Benzene). The action of this preparation and a companion between it and phenacetin has been made by Cow.¹¹² He finds that pertonal possesses, approximately, one-half the toxicity of phenacetin (acetphenetidin) and as an antipyretic it produces similar effects in doses approximately double those of acetphenetidin. The latter exerts a directly depressant action on the heart, which is actually stimulated by pertonal. In general, the action of pertonal is less abrupt and more prolonged than that of acetphenetidin. No evidence of methemoglobin formation has been found after pertonal, whereas this change has often been noted after phenacetin.

A range of therapeutic dose of 10 to 20 grains or more is recommended for pertonal; it is suggested by Cow that the dose need not be repeated so frequently as the dose of acetphenetidin.

Picric Acid. In time of use and especially if the men are drafted, it not uncommonly happens that various means are employed to escape entering the military service or to evade the dangers if already in the service. For instance, I have knowledge of men who voluntarily had the hearing destroyed in one ear or had a hernia produced to escape service in the Russian Army during the Russo-Japanese War. In the late war, medical officers have told me of several interesting methods employed by the men to escape service. The chewing of cordite was sometimes practised as it produced a high fever; in other instances the putting into a cigarette cotton saturated with tincture of iodine produced a marked irregularity of the heart.

The *British Medical Journal* for July 27, 1918, reviews the use of picric acid for the purpose of producing jaundice. Five, 10 or 15 grains of picric acid taken internally in one, two or three doses irritate the alimentary canal, causing vomiting and diarrhea and turns the urine pomegranate red. Much of the picric acid is removed by vomiting

¹¹² *Journal of Pharmacology and Experimental Therapeutics*, February, 1919.

and in the loose stools, but there is always enough to stain the skin and conjunctivæ yellow and then simulate jaundice. The blood serum is also yellow, instead of green as in true jaundice, and the cerebrospinal fluid is also yellow.

Among 129 cases of this nature observed by Malmjac and Lioust, urobilin was present in 35 per cent., bile acids in 27 per cent., bile pigment alone in 7 per cent., and both bile acids and pigment in 17 per cent. The presence of bile in the urine does not interfere with the chemical detection of picric and picramic acids. The presence of these acids makes it highly probable that the acid has been taken by the mouth, for observations appear to show that workers in munition factories do not absorb enough picric acid to allow of its detection in the urine.

Pituitrin. In previous numbers of PROGRESSIVE MEDICINE, reference has been made to the extraordinary effect that extracts of the pituitary gland exercise on the urinary output. The use of pituitrin is now the established procedure in the treatment of *diabetes insipidus*. The effect of pituitrin in reducing the amount of urine is shown in a case reported by Beck and McLean.¹¹³ After the subcutaneous injection of 1 c.c. of pituitrin, the maximum fall of urine excreted was from 13,000 c.c. to 2000 c.c. in twenty-four hours. This observation as to the specificity of organotherapy is quite as remarkable in its quick response as the effect of thyroid gland substance in combating the hallucinatory disturbance in myxedema, and calcium salts in the tonic spasms in parathyroid tetany. In both these conditions the symptoms frequently disappear within twenty-four hours and can be easily controlled by treatment. Unfortunately, in diabetes insipidus, while the effect of pituitrin is as pronounced, it is not as permanent, lasting only a day or two, and oral medication has practically no influence. The case reported by Beck and McLean belonged to the multiglandular type as there were symptoms pointing definitely to the hypophysis, the thyroid and the gonads. Berqué and Schulmann¹¹⁴ have reported an interesting case of polyuria in which the autopsy revealed eight gummatous lesions in the pituitary gland, mostly in the posterior lobe. In this case the polyuria was most pronounced at night. The use of the extract of the posterior lobe of the pituitary gland was always followed by a subsidence of the polyuria.

In reporting 2 cases of diabetes insipidus treated with pituitary extract, Kennaway and Matham¹¹⁵ state that no record has been found by them in the literature of any case of diabetes insipidus in which abnormality of the pituitary was excluded with certainty by post-mortem examination, whereas in a considerable number of cases the disease has been associated with a lesion of the posterior lobe of the gland. However, such lesions are not invariably accompanied by diabetes insipidus. They believe that the evidence of morbid anatomy as to a connection between the pituitary gland and diabetes insipidus

¹¹³ Therapeutic Gazette, March, 1919.

¹¹⁴ Presse médicale, December 5, 1918.

¹¹⁵ Quarterly Journal of Medicine, April, 1919.

is therefore inconclusive, but the immediate restoration of a normal state of the urine when pituitary extract is given in diabetes insipidus provides the strongest evidence for the normal activity of the gland in regulating the secretion of the urine.

In a study of the effect of pituitary extract on the urinary output in diabetes insipidus, Clausen¹¹⁶ found, that following injections of from 0.25 to 1 c.c. of surgical pituitary solution, there was a marked diminution of the urine output and that this diminution persisted from five to six hours, sometimes much longer. The volume of night urine is reduced when pituitary solution is injected at any time on the preceding day. He furthermore found that the hourly rate of elimination of chlorides is always reduced after injections of pituitary solution, while the hourly elimination of urea is usually only slightly, if at all, reduced. The same is true of the hourly elimination of creatinin, uric acid and titratable acids.

When the hourly ingestion of water, sodium chloride or urea is maintained at a constant high level, the urea elimination is quite uninfluenced by the injection of pituitary solution, whereas the chloride elimination is considerably diminished, and the water elimination very much diminished.

Pituitary solution injections in diabetes insipidus control output primarily and thirst secondarily.

In an experimental study on the action of pituitary extract on the kidney, Knowlton and Silverman¹¹⁷ found that the oxygen consumption by the kidney is not increased during the diuresis induced by pituitary extracts. Using the oxygen consumption as the criterion, they believe there is no evidence that pituitary extract stimulates the renal cells. From the evidence at hand, it seems possible to explain the diuretic action of pituitary extract entirely on the basis of the vascular changes and increased filtration pressure obtaining in the kidney.

Pituitary extract has achieved its greatest fame and by the same token its greatest notoriety, in obstetrics. Its uses and abuses, particularly the latter, have been emphasized repeatedly, but in spite of warnings, from the most eminent in this specialty it continues to be misused. Kosmak,¹¹⁸ in common with others who have had experience with pituitary extract, admits the value of the preparation but urges the need of caution in using it, particularly in obstetric cases. Here it is safe only in cases of simple uterine inertia, particularly multiparas, when there is no obstruction to the passage of the child, no exhaustion, and the presenting part is engaged. It should be used in doses of not over 5 minims at a time, and repeated only when the effect of the previous dose has worn off. Kosmak states that the usually accepted dose of 1 c.c. is too large, and a trial dose of $\frac{1}{3}$ c.c. or 5 minims, followed at intervals of an hour with one or two further doses is the preferable method of administration. His view as to dosage was endorsed by several distinguished obstetricians who discussed his paper.

¹¹⁶ American Journal of Diseases of Children, September, 1918.

¹¹⁷ American Journal of Physiology, September, 1918.

¹¹⁸ Journal of the American Medical Association, October 5, 1918.

For the induction of labor, or as an accepted substitute for the forceps, it would be best not to consider pituitary extract. It is Kosmak's belief that if the natural forces of labor are unable to expel the child without assistance, their stimulation by the use of pituitary extract is not quite logical; for the resistance, if present, can better be overcome by forces from below than by forces from above. Properly used under proper indications, the extract of the hypophysis has a distinct place and value. Indiscriminate and improper use will only tend to relegate a good therapeutic agent to the discard. While he is far from being pessimistic as to the value of the drug, he does feel pessimistic of ever getting the profession to use it properly.

In the discussion of this paper, De Lee, who has opposed the use of pituitary extract in labor cases, from the beginning, again emphasizes his opposition to general practitioners using pituitary extract in their confinement cases. Rupture of the uterus, laceration of the cervix and perineum are too frequently associated with its use. He thinks pituitrin is used so indiscriminately in labor cases that something ought to be done other than the complaints and warnings issued in the journals. In addition to the danger to the mother, De Lee states that many children are born dead with the symptoms of asphyxia after the administration of pituitary extract, and the death can hardly be explained except by an asphyxia caused by the contraction of the uterus produced by pituitary extract.

Broberg¹¹⁹ gives the indication for its use in obstetrics as follows:

1. If pains are weak or irregular in the first stage of labor, give one-half of a $\frac{1}{2}$ c.c. ampoule (about 3 minims), or if the cervix is very readily dilatable give $\frac{1}{2}$ c.c. ($7\frac{1}{2}$ minims), and no more.

2. If the pains are weak or irregular in the second stage, give $\frac{1}{2}$ c.c.

3. In postpartum hemorrhage give 1 c.c. with ergot.

He emphasizes the fact that the extract has been used in too large doses in obstetrics, and as a result has caused many serious lacerations, as well as fetal deaths. Its ability to expel the contents of the uterus, at term, quicker than anything else has led the busy practitioner to employ it in order to hurry things along and, in Broberg's opinion, often for no other reason than expediency. As a result this useless and indiscriminate use of the extract "provides for the physician and his brother gynecologists a lot of chronic sufferers, often incurable even after mutilating operations" (De Lee).

As Broberg expresses it, the slogan of the hour should be "safety first" and if doctors were not in such a hurry to get back to some other case, instead of waiting patiently with the woman in labor, injuries and fatalities could be avoided.

Pituitary extract has been used in cases of *retention of urine* following delivery. Dubis¹²⁰ states that he has employed it for this purpose with varying success. He has had better results, however, from the introduction of $\frac{1}{2}$ ounce of *glycerine* into the bladder. In his experience this has done away with probably 95 per cent. of catheterization in obstetrical and surgical cases.

¹¹⁹ Minnesota Medicine, October, 1918.

¹²⁰ Discussion of Kosmak's paper, loc. cit.

The use of pituitary extract in the treatment of various gynecological conditions is recommended by Dalché.¹²¹ He has used it by mouth in cases of bleeding fibromas, uterine congestion, metrorrhagia, dysmenorrhea, etc. He administers the dry extract of the whole gland, giving from two to four cachets of 0.10 gram each, a day. It gives excellent results in cases of metrorrhagia. In the case of a young girl with too frequent and too profuse menstruation, Dalché administers pituitary extract every day for a month, then for two weeks each month, beginning the week before the anticipated menses and continuing until the close. The other two weeks he gives 10 drops of the tincture of hamamelis in a little water twice daily. In most of the conditions for which the extract is recommended Dalché states that success depends on persevering with the treatment for a long time.

The treatment of *hay fever* by means of injections of pituitrin and adrenalin (epinephrin) is recommended by Zueblin.¹²² In the cases so far studied by him an attenuation of the attacks can be secured provided that the proposed injections with pituitrin and adrenalin are given in the proper doses and at not too long intervals. He states that a certain reserve must be held as to the final results and admits that vaccine treatment gives the best results in the severe cases. Further investigation may aid in distinguishing genuine cases of hay fever from milder forms with similar clinical manifestations which are not based on a primary irritation from pollen of a definite character but are the result of endogenous or exogenous toxins, or a combination of both.

The dose of pituitrin employed by Zueblin was in the average case from 0.8 to 1 c.c. In a few instances the dose was reduced to 0.25 c.c. The dose of adrenalin varied from 0.5 to 0.2 c.c., the higher dose being given first, then gradually reduced. The frequency of the injections is determined by watching the pulse-rate, the blood-pressure and the heart sounds. It is essential that the patient be cautioned against excessive exercise while under the action of these drugs.

The use of adrenalin and pituitrin is advised by Massalongo¹²³ in the treatment of *asthma*. He found that the most effective dose was 0.0008 gram of adrenalin and 0.0004 gram of pituitrin in solution in 1 c.c., injected subcutaneously.

Radcliffe¹²⁴ found pituitary extract of service in the treatment of influenza, especially in cases in which the cardiovascular system showed signs of failure.

Tucker¹²⁵ thinks that there is a definite relation between under-secretion of the pituitary gland and a group of periodic convulsive attacks usually termed *epilepsy*. This group he divides into a chronic hypopituitary type and a transitional hypopituitary type as determined by both clinical and roentgenographic evidence. In these cases he has

¹²¹ Revue mens. de gynécologie et d'obstétrique, May, 1919.

¹²² New York Medical Journal, July 13, 1918.

¹²³ Rivista urtica di clinica medica, October 5, 1918; Journal of the American Medical Association, December 21, 1918, p. 2113.

¹²⁴ Therapeutic Gazette, February, 1919.

¹²⁵ Archives of Neurology and Psychiatry, August 1, 1919.

found that pituitary gland feeding has a markedly beneficial effect and occasionally leads to a cure.

Potassium Iodide. This drug is recommended in the treatment of the various mycotic infections. At times splendid results are obtained, particularly in cases of blastomycosis. D. J. Davis¹²⁶ has made an experimental study of the effects of potassium iodide in *sporotrichosis*. His results seemed clearly to show that the drug acts in such a way as to stimulate the healing process without inhibiting the development of the infecting organism. In other words, its action is causative and not preventive.

Protein. The work of Walker and others has shown that many cases of *asthma* are due to sensitiveness to some foreign protein. In some instances the etiological factor is quickly determined, as, for example, when the asthmatic seizure is associated with exposure to horses or when it is precipitated by the inhalation of the pollen of various flowers and plants. In other instances the search for the offending protein requires a deal of patience and painstaking searching. This point has been emphasized by Rackemann,¹²⁷ who states that when the history, or the patient's experience, is compatible with the skin tests as showing susceptibility to some foreign protein, repeated parenteral injections of that foreign protein will usually have a markedly beneficial effect and may cure. Avoidance of the offending protein, if possible, is the simplest remedy. Frequently unsuspected and apparently unimportant suggestions, such as a temporary change of residence, a slight temporary modification of the diet, small doses of calcium lactate, ether anesthesia, temporary rest in bed with full diet, correction of faulty position, have been of the greatest assistance and not infrequently have led to a virtual cure. Cases of intrinsic asthma can be treated by mechanically removing the cause, but this does not often effect a permanent cure.

Auld¹²⁸ reports that he has had good results in the treatment of asthma from intravenous injections of *peptone*. He prepares the injection by dissolving the peptone as far as possible in normal saline (made up to three-quarters volume) by slightly agitating and warming at 37° C. He then adds 1 mil of a 2 per cent. solution of sodium carbonate for each $\frac{1}{3}$ gram (5 grains) of peptone. This is then made up to volume with normal saline and 0.25 per cent. of phenol is added as a preservative. Care must be taken in adding the alkali, as any excess may cause vaccination of the peptone, rendering it inactive.

Auld can give only general directions as to dosage. Experience alone can enable one to decide this as it will depend on the symptoms and progress of the case; furthermore patients vary considerably in their response to the peptone. Generally speaking a limited number of measured doses is usually sufficient if the attacks occur singly or more or less broken up or occur at fairly frequent intervals. If slight attacks persist it may be necessary to increase the dose. On the other hand

¹²⁶ Journal of Infectious Diseases, August, 1919.

¹²⁷ Boston Medical and Surgical Journal, June 6, 1918.

¹²⁸ British Medical Journal, July 20, 1918.

the dosage must be reduced when the attacks occur with great frequency and irregularity. In such cases the antianaphylactic mechanism is weak, the immunity reserve being small and capable of tolerating only very gentle stimulation. A feeling of chilliness and discomfort indicate that the limit of the dose has been reached.

In the majority of cases Auld fixes the initial dose at 3 decimils (5 m.) and this is increased by 2 decimils (roughly 3 m.) every fifth day until six injections have been given. The sixth dose is to be repeated three or four times, as a rule, but there are exceptions to this. At any time during the course of the treatment it may be necessary to modify the dosage. The injections should not be given during attacks, and when the latter occurs at long intervals, the treatment should be started three weeks before one is expected. From what I have seen of the treatment of asthma its treatment by the subcutaneous injection of a suitable protein is by far the most rational and satisfactory as has been shown by Walker and others. The essential thing in every case of asthma is to determine whether the presence of protein sensitiveness can be shown and then to determine the particular protein at fault. As already stated, cases in which the asthma is associated with the emanations from animals, especially horses, are easily recognized; and this is also true of those associated with the various pollens. In other instances the search for the offending protein is attended with great difficulties.

Walker¹²⁹ has contributed an interesting article on the testing of asthmatic patients in order to determine the character of the offending protein. His report is based on a study of 400 cases. Protein enters the body by inhalation, by ingestion, by absorption and by infection. *Inhalation* takes place through the respiratory tract and chiefly concerns protein in the pollen of plants, in the emanations and hair of animals, in the flour of cereal grains and in some kinds of dust. *Digestion* has to do with the protein in food and it is known that foods, after entrance into the gastro-intestinal tract, do cause asthma. *Absorption*, apart from inhalation and ingestion, concerns the conjunctiva, and to a less extent the skin. By *infection* is meant the presence of pathogenic bacteria in any part of the body, but more especially foci of infection located in the teeth, tonsils, nose, throat and lungs. In this latter group the protein as well as the infectious element must be dealt with.

In order to test the patient, Walker advises the skin or cutaneous test. A commonly used method is the intradermal test which in Walker's experience is too sensitive and often erratic. The skin or cutaneous test is the more reliable and is performed as follows: A number of small cuts, each about $\frac{1}{8}$ inch long, are made on the flexor surfaces of the forearm. These cuts are made with a sharp scalpel, but are not deep enough to draw blood, although they do penetrate the skin. On each cut is placed a protein, and to it is added a drop of tenth-normal sodium hydroxide solution to dissolve the protein and to permit of its rapid absorption. At the end of half an hour, the proteins

¹²⁹ Boston Medical and Surgical Journal, August 29, 1918.

are washed off, and the reactions noted, always comparing the inoculated cuts with normal controls on which no protein was placed. A positive reaction consists of a raised white elevation or urticarial wheal surrounding the cut. The smallest reaction, which Walker considers positive, must measure 0.5 cm. in diameter.

Negative skin tests with protein rule out those proteins as a cause of asthma, and all proteins which give a positive skin test should be suspected as a cause of asthma. In the case of bacteria, however, the skin test has to do only with the protein element, so that even though bacteria give a negative test, they may still be a cause of asthma through their infectious nature, and the patient need not be sensitized to bacterial protein.

It is to be borne in mind that the individual may be sensitive to more than one protein. If the patient is sensitive to food proteins, such forms should be omitted from the dietary for at least a month in order to see what effect they have on the asthmatic condition. In the series reported by Walker nearly all such patients were relieved of their asthma. In a few instances, however, because of the associated bronchitis, autogenous sputum vaccines were required in conjunction with the restricted diet. Attempts to relieve these patients by subcutaneous injections of the offending protein or by feeding gradually increasing amounts of protein, failed.

Patients who are sensitive to bacterial proteins may be successfully sensitized against such by treatment with vaccines of those organisms, and great care must be exercised not to give too large and too rapid an increase in the amount of vaccine. The first dose of vaccine should not be larger than 100,000,000 bacteria, and each succeeding dose should not be more than 50,000,000 over the preceding dose.

In those patients who are sensitive to the protein of horse dandruff or hair and of pollens, skin tests must be done, using various dilutions of these proteins in order to determine the dosage. Treatment should be begun with the dilution next higher than that which gives a positive test; the first dose should be small, usually 0.1 c.c., and each succeeding dose should not be more than 0.1 c.c. over the preceding one.

The treatment of *hay fever* is along the same lines. Goodale¹³⁰ advises patients to report, if possible, ten weeks before the onset of the expected attack; a shorter time is often sufficient, however. The ordinary procedure is to inject from 1 to 3 minims of the 1 to 50,000 dilution of pollen extract of the following plants: willow, poplar, maple, birch, oak, grasses, rose and ragweed. Since the spring of 1914 Goodale has examined 330 cases of hay fever. Of the true anaphylactic type, 90 were due to grasses, 237 to ragweed, 5 to maple, 4 to roses, 3 to oak, 5 to birch and 1 to willow. Of these patients, 123 have received desensitizing treatment for two or more years.

No improvement was noted in 7; in 46 there was improvement as compared to previous years, but showing, nevertheless, troublesome symptoms for a short time; in 59 cases there was very definite improvement; and in 5 there had been no attacks for two or more years.

¹³⁰ Boston Medical and Surgical Journal, August 29, 1918.

Following the injection of the pollen extract in nearly all cases a subcutaneous swelling occurs varying from 1 to 3 cm. in its transverse diameter, and lasting from one to three days. After the reaction from the first injection has subsided the amount may be doubled, and a few days later give twice the amount of the second injection. The next higher strength of 1 to 5000 is taken and three injections of this are given, varying from 3 to 7 or 8 minims. Next a similar quantity in three doses is given of the 1 to 2000 and finally the full strength of 1 to 500 in doses varying from 5 to 10 minims. The number of injections required during the first year has ranged from 6 to 15, depending on the rapidity with which the dosage can be increased.

Bell and Hartzell¹³¹ have made an experimental study to determine the effect of a foreign protein on the kidneys. As a result of their investigation they found no experimental evidence to show that foreign protein is in any way responsible for chronic nephritis in man.

Quinine. Every year the medical literature abounds in reports on the treatment of *malaria*. Not only is there a wide variety of quinine salts recommended, but in addition, all sorts of methods are advocated in the introduction of the quinine into the system. Bass¹³² bases his recommendation on the different methods of treatment followed in 25,000 cases observed in several of the counties of Mississippi. The treatment finally adopted for disinfecting infected persons was as follows: For adults 10 grains of quinine sulphate every night before retiring for a period of eight weeks. For children the dose that gives the same results as 10 grains in adults is: under one year, $\frac{1}{2}$ grain; one year 1 grain; two years, 2 grains; three and four years, 3 grains; five, six and seven years, 4 grains; eight, nine and ten years, 6 grains; eleven, twelve, thirteen and fourteen years, 8 grains; fifteen years and older, 10 grains. The 6-, 8- and 10-grain doses are next administered in the form of two tablets or capsules containing 3, 4 or 5 grains each. The smaller doses are best administered in aromatic syrup of yerba santa, so prepared that one teaspoonful contains the required dose. The eight weeks' treatment should be prescribed at one time and the patient should be impressed with the fact that no doses should be omitted; otherwise a relapse is likely to occur.

Bass states that this method will disinfect more than 90 per cent. of cases. In the event of a relapse occurring the full treatment should be repeated and continued longer than eight weeks. In regard to the salt to be used, Bass has found the sulphate as effective as any and more effective than some. He believes that administration by mouth is the only method to be considered except in rare instances of pernicious malaria, when one or more intravenous doses may save life. The dose for this purpose should never exceed 10 grains; the bimuriate (*quininae hydrochloricum*, U. S. P.) is a good salt for their purpose.

Bass advises physicians who advocate the administration of quinine hypodermically or by deep muscular injections to take a few such injections themselves. He thinks such an experience would quickly

¹³¹ Journal of Infectious Diseases, June, 1919.

¹³² Journal of the American Medical Association, April 26, 1919.

allay their enthusiasm for their method. While he admits that in a few instances the hypodermic method may be advisable, he insists that it should never be allowed to take the place of administration by mouth, which is the only practical method of disinfecting "carriers."

Gunson¹³³ and his associates, in a report on their experience in the treatment of relapsing malaria, conclude as follows:

1. Routine treatment by oral quinine is adequate in the majority of cases of relapsing malaria; it is necessary to continue the quinine treatment in doses of 20 grains either daily or twice weekly during the patient's stay in the hospital to obviate a high incidence of relapses.

2. In the cases (the minority) in which oral quinine proves inadequate, intensive treatment by one or more courses of combined oral and intramuscular quinine (60 grains daily for four days) is followed by such marked improvement as to justify the adoption of this treatment as a routine procedure for such cases, the chief indication for this course being progressive cachexia and visceral enlargement in a patient suffering from repeated relapses or prolonged pyrexia and not responding to oral quinine.

In PROGRESSIVE MEDICINE for last year reference was made to a contribution by MacGilchrist, a major in the Indian medical service, who has, on more than one occasion, protested against intramuscular injections of quinine. Hare,¹³⁴ in an editorial article, states that all the evidence seems to indicate that quinine ought never to be given hypodermically. In his judgment additional facts must be presented before the intramuscular injection of the drug can be regarded as a wise procedure, except in very unusual cases.

As has been pointed out often in previous years there is no definitely established practice in regard to the use of quinine in malaria. Authorities differ as to the salt to be used, the dosage and the method of introducing the drug into the system. The opinions cited above as to the propriety of employing intramuscular injection is certainly emphatic enough, still there are those who believe the method should be employed. For instance, Rogers,¹³⁵ whose experience in dealing with tropical diseases certainly gives weight to his opinions, advocates intramuscular injections. Léénhardt and Tixier,¹³⁶ in reporting their experience in the treatment of a large number of cases in Macedonia are earnest advocates of the intramuscular methods.

In regard to the prophylactic use of quinine as a preventive of malaria in those with no history of infection the following observations by Rawnsley¹³⁷ are of interest. During the period he served with the British Salonica Force, quinine was given as a preventive in the following dosage:

1916: 5 grains and 10 grains on two successive days in the week, the former amount being more generally employed.

1917: (a) 10 grains on two successive days weekly; (b) 10 grains on

¹³³ Lancet, June 22, 1918.

¹³⁴ Therapeutic Gazette, November, 1918.

¹³⁵ British Medical Journal, October 26, 1918.

¹³⁶ La Presse médicale, March 4, 1918.

¹³⁷ British Medical Journal, April 19, 1919.

two successive days twice weekly, on Wednesday and Thursday and on Saturday and Sunday; (c) 10 grains daily; (d) 15 grains daily; and (e) 20 grains daily.

The three last amounts were given temporarily to troops a few days before going into, during the period of occupation of, and for a few days after coming out of, highly malarial parts of the front trenches. This dosage completely failed to prevent the incidence of malaria. In one battalion, to which large doses of daily quinine were given, there was little apparent sickness; the daily dose kept down the pyrexia, and the men were thus enabled to carry on their duties; but after some weeks it was found that those men were affected by chronic malaria as shown by the presence of the parasite in the blood, enlargement of the spleen, anemia, etc., necessitating their admission to hospital in large numbers. It was estimated that at least 80 to 90 per cent. of units were infected.

In 1918, it was decided to give no prophylactic quinine, as the general opinion among the majority of medical officers was that no dose that could be tolerated had any protective value to troops exposed under campaigning conditions. Reliance was placed on other methods of malarial prophylaxis and cases treated as they occurred.

Razetti,¹³⁸ who is an obstetrician in a malarial district, has published an appeal to physicians practising in similar localities, asking what their experience has been in administering quinine to pregnant women, and whether they had noted any oxytocic action from it during parturition, and whether they attribute any abortions or premature deliveries which they may have observed to the malaria or the quinine. His experience is that quinine has no abortive effect in these cases. Abortion is comparatively common in malaria, typhoid, influenza, etc., when the disease is well under way but rarely occurs in the early stages. In the case of a pregnant woman suffering from malaria and who is threatened with abortion, Razetti gives quinine freely, as in his opinion, this is the only means of controlling the malaria which is the true cause of the abortion. He quotes Machado who asserts that a long experience in an intensely malarial district convinced him quinine should always be freely given in these cases and that he had never seen any untoward effects from so doing.

Dubarry¹³⁹ is of the opinion that if all pregnant women ill of malaria were placed upon rational quinine treatment, both miscarriages and premature labor would probably become exceptional, excepting, of course, in the pernicious form of the disease.

He also asserts that it is now a settled question that quinine is *not* an abortifacient in any sense of the word and that in general diseases it can be resorted to without fear. In fact, in malarial women it is the best means at our disposal for preventing miscarriage or premature labor. The labor over, quinine is dangerous for the nursing infant from its presence in the maternal milk, according to some. Goth, on the contrary, and with him Bureau

¹³⁸ *Gaceta medica de caracas*, January 15, 1919; *Journal of the American Medical Association*, April 12, 1919.

¹³⁹ *International Clinics*, 1914, series 29, vol. iii.

and Runge, maintain that quinine is quite as efficacious in recently confined women as when puerperality does not exist; it has no ill effects on the nursing even when exhibited in large doses. Dubarry's experience leads him to admit this conclusion, for although his patients were methodically treated with quinine salts he never met with the slightest trace of intoxication in any, either in the mother or offspring. He insists on the advantages to be derived from methodically giving quinine as a prophylactic measure during the postpartum in all women whose history leads to the suspicion that they have suffered from paludism. By so doing one will avoid, in the vast majority of cases, febrile paroxysms or, for that matter, any postpartum malarial manifestations.

His plan of treatment is as follows: The day following labor an intramuscular injection of 50 cgms. of the neutral quinine hydrochloride is given. This dose should be repeated on the three to five days following, according to the degree of paludism. The injection should be given about five hours before the expected paroxysm.

The late epidemic of *influenza* has led to the publication of many articles relative to the treatment of this disease. Among the drugs recommended is quinine. Garni,¹⁴⁰ for instance, noted that none of the men being given quinine for malaria developed influenza at the hospital in Lyons. A questionnaire sent to a number of hospitals caring for malarial soldiers elicited the reply from a number of them to the effect that either influenza had not occurred in this group of patients or else it occurred in a very mild form. The protection seems to be greater when the patient is taking both quinine and arsenic.

Sterlin¹⁴¹ treated every case with quinine hydrobromide or dihydrobromide, in 5-grain doses, from the onset of the influenza, giving three capsules night and morning with a glass of hot tea and whisky (1 tablespoonful) until the temperature became normal. If the temperature was high, he gave a capsule every three hours throughout the day disregarding the deafness or cinchonism. To children quinine was administered in suppositories of cocoa butter. The dose was regulated according to age; 5 grains in one suppository, every three hours or two suppositories night and morning. In addition to the quinine he gave atropine and digitalis.

In the treatment of *anal fissure*, Leyton¹⁴² recommends the use of quinine. He reports a case in which he packed the fissure with quinine hydrochloride (about 5 grains) after swabbing with a cocaine solution. This treatment was repeated on each of three days. In twenty-four hours the surface showed well-marked granulations, and the patient's symptoms were much relieved. After the third day that part of the fissure within reach was looking healthy but the patient still complained of some pain higher up. Leyton ordered for this a suppository of cocaine gr. $\frac{1}{4}$, to be followed in a quarter of an hour by a suppository of quinine sulphate, grains 5. These were used for four days, and by that time the fissure had disappeared and there was no recurrence.

¹⁴⁰ Progrès médicale, November 2, 1918.

¹⁴¹ New York Medical Journal, August 9, 1919.

¹⁴² British Medical Journal, March 16, 1918.

Radium. This substance has established its usefulness in a variety of conditions most of which are of the same nature as those which are benefited by the x -rays. It has one advantage and that is that it can be more easily applied in certain localities; notably the mouth and the vagina.

Relatively few institutions have sufficient radium to meet all indications as certain conditions can be helped only by the use of massive doses. This is particularly true of sarcoma of the mediastinum. It is highly desirable that several institutions pool their supplies of radium so that they will be able to meet each and every indication for its use.

MALIGNANT DISEASE. In the treatment of malignant disease of the nasopharynx, Boggs¹⁴³ states that sarcomatous growths are much more amenable to radium than are the carcinomatous growths. He cites several personal cases in which the application of radium led to the disappearance of large tumor masses. At the time of his report sufficient time had not elapsed to warrant these cases being called more than clinical cures. There is no doubt, however, that the radium gave the patient great relief from what was an inoperable condition. Carcinoma of the buccal mucous membrane and the tongue, while not so readily influenced by the radium as sarcomatous growths, produces, on the whole, very favorable results.

In regard to the *relative sensitiveness of tumors to radium*, Quigley¹⁴⁴ regards carcinoma as the most resistant tumor we have to deal with. Sarcoma is probably twice as radiosensitive as carcinoma, the lymphosarcoma being specially so. Fibroma and myoma are perhaps the most radiosensitive, a tumor the size of an eight months pregnancy disappearing in four months' time after forty hours of treatment with 75 mg. of radium. Pedunculated fibroids respond as well as others if cross-fire is used. Angioma responds to treatment very readily, but in children the tumor is more radiosensitive than in the adult.

Burrows,¹⁴⁵ in reporting a year's (1918) work at the Manchester and District Radium Institute, states that the number of patients applying for treatment was 648. In 48 cases of malignant disease the patient was rendered free from symptoms and signs during the course of the year.

Of 33 cases of *rodent ulcer* treated to a termination 18 were cured. In a summary of four years, he states that practically all early rodent ulcers can be cured by radium alone. To date, 31 cases have been well for two years or more, and of a number of other patients who have not reported it is believed that many are still well.

In regard to malignant cases, only inoperable cases have been treated by radium. The best results have been obtained in *carcinoma of the cervix*.

From a numerical list of the cases of malignant disease of all varieties treated at the Institute it appears that 30 such cases previously deemed inoperable have been well for a period of two years or more. In certain

¹⁴³ American Journal of the Medical Sciences, November 18, 1918.

¹⁴⁴ Minnesota Medicine, March, 1919.

¹⁴⁵ British Medical Journal, March 15, 1919.

local tumors, Burrows states that radium has a very remarkable and rapid effect. *Lymphosarcoma* disappears rapidly, but fresh tumors continue to arise in distant lymphatic glands. *Glioma* or *gliosarcoma* of the orbit will disappear within a fortnight, but returns. Good results are obtained in some sarcomata, notably inoperable sarcoma of the superior maxilla.

Burrows points out that the use of radium may render operation possible in carcinoma of the breast, of the bladder, of the cervix and for the removal of sarcomatous masses. Apart from all this, radium is of great use in relieving the discomfort of patients suffering from hopeless cancer. It may be employed to relieve pain, heal ulceration, check discharges, stop bleeding, and thus improve the general health of the patient.

In the treatment of *carcinoma of the mucous membranes of the mouth*, Greenough¹⁴⁶ has employed radium emanation or gas instead of the radium itself. As is well known, radium is constantly disintegrating, although very, very slowly. This disintegration is characterized by the discharge of particles from the atoms of radium in the form of what is known as radium emanation, which is in the nature of a gas. It is in this way that radiumized water is obtained. Greenough has obtained this gas from the 1000 mg. of radium at Harvard University, the emanations being drawn off and then sealed in capillary glass tubes, by means of which it is taken to the hospital. Even in these sealed tubes, however, the emanation loses power and fresh ones must be prepared every day.

Greenough reports the results of radium treatment in 139 cases of mouth cancer. Out of 39 of carcinoma of the lip, 19 were treated with radium, with improvement in 8. Out of 8 cases involving the palate, 30 of the lower jaw, 11 of the upper jaw, 33 of the tongue and floor of the mouth, 7 of the tonsils, and 5 of the cheek, radium was used in 62, with improvement in only 9. He points out in this connection that while a local lesion can be destroyed or modified, extension to the lymphatics of the neck indicates grave extension and prohibits the use of large amounts of radium which are essential, since it results in the destruction of the skin and in secondary hemorrhages.

It seems best therefore, as an editorial article¹⁴⁷ points out, that the combined treatment by operation and radium seems to be the most rational and effective method in these cases.

Another article dealing with the use of radium in the treatment of cancer of the jaws and cheeks is contributed by New.¹⁴⁸ In an experience with 21 patients, he concludes that while the end-results cannot be foreseen, he believes that the addition of radium to the treatment of these cases has accomplished much more than was formerly the case.

Although *Hodgkin's disease* is widely separated from carcinoma and sarcoma, so far as histological characteristics are concerned, from the standpoint of its mortal effects it belongs in the same class with these malignant growths.

¹⁴⁶ Boston Med. and Surg. Jour., 1918. ¹⁴⁷ Therapeutic Gazette, January, 1919.

¹⁴⁸ Journal of the American Medical Association, October 26, 1918.

Simmons and Benet¹⁴⁹ have used either radium or *x*-rays in 19 cases of Hodgkin's disease proved to be such by microscopic examination. They state the use of these agents is followed by a marked temporary amelioration of symptoms, by diminution in the size of the glands, and by improvement in the general condition. They add, however, that in the majority of cases the disease progressed to a fatal termination. As to their actual results, 14 of the 19 cases are dead, and 5 were still under treatment; it is possible these latter cases represent the chronic form of the malady. Two of these cases have been under treatment eighteen and twenty-seven months respectively, and are in poor condition. Two others have been under treatment twenty-two and thirty-six months respectively, and are in good condition, having only a few shot-like glands. The fifth case is in fair condition, but has had little treatment.

Simmons and Benet believe that the failure of the *x*-rays and radium is, in part, due to the fact that the treatments, in almost every instance, were necessarily confined to the mass of glands in the neck, axilla or groin, and only a few patients received the treatment over the spleen, abdomen and sternum; and these treatments were probably of insufficient strength to have reached the deeply seated lymph nodes. In their opinion as soon as the presence of Hodgkin's disease is suspected there should be systematic treatment of all the glandular regions of the body where there is the slightest evidence of enlargement of the glands, since by this means early changes can be arrested before the disease has advanced so that it is easily distinguished.

LEUKEMIA. Giffin¹⁵⁰ calls attention to the remarkable remissions in the course of myelocytic leukemia, which can be produced by means of radium exposures over the enlarged spleen. By reducing the size of the spleen and improving the patient's general condition, splenectomy becomes a much less hazardous operation than was formerly the case. Twenty patients with myelocytic leukemia have been splenectomized at the Mayo clinic with one operative death. Eighteen of these cases were treated by means of radium exposures over the spleen prior to splenectomy.

Giffin concludes that aside from the chronic cases, that is those with a duration consistently over two or three years, splenectomy does not prevent the disease running its usual course of two or three years. On the other hand, those patients operated on early in the disease, that is less than six months from the time of definite onset, the results seem better. Thus of 7 cases operated on early, 6 are alive and 5 of these are in excellent or very good condition. While he believes that it is possible, he does not consider it likely, that in these early cases the results will be better than in the later ones, although 4 of the 6 patients have lived more than one year. Nothing, however, of a definite nature can be inferred from the fact that 6 of the 7 are alive, inasmuch as the duration of the disease in all of them is less than two years.

HYPERTHYROIDISM. The treatment of this condition by means of radium is favorably reported by Aikins.¹⁵¹ In all, 45 cases were subjected

¹⁴⁹ Boston Medical and Surgical Journal, 1918.

¹⁵⁰ Medical Record, December 14, 1918.

¹⁵¹ Canadian Practitioner, August, 1918.

to this treatment. Of these, 23 have been clinically cured—that is, the tachycardia, tremor and restlessness have disappeared, and symptoms of excessive thyroid secretion have abated. In 17 cases there was improvement, but not a complete cessation of symptoms. Four cases were lost sight of. In only 19 patients did the thyroid gland itself decrease in size, as evidenced by neck measurement. Of the cases which did not show a decrease in the size of the gland, surgical measures would be necessary in many to effect this. As the nervous condition was such that surgery would be a very risky procedure, the relief of the nervous symptoms made it possible to undertake the surgical removal of the goitre for cosmetic reasons later on if the patient wished it.

In connection with the radium treatment, Aikin emphasizes the necessity of applying general medical measures. In some cases complete bodily and mental rest, in others partial, were employed. A low protein diet and one poor in extractives was advised. He also prescribed quinine hydrobromate gr. 5 and ergotin gr. 1 three times daily.

MENORRHAGIA. In the treatment of excessive uterine bleeding, radium is often of great value. Stacy¹⁵² states that an ambulant case is allowed to leave the hospital a few hours after the radium tube has been removed from the cervix, and instructed to keep off her feet for the following twenty-four hours. If there has been a recent hemorrhage, or if the treatment is given during the menstrual flow, the patient should remain in bed until the flow ceases. Usually, the flow at the first period after the treatment is as profuse as usual, or it may be increased in amount. Stacy states that the reason for this is not known definitely; it may be because of the local hyperemia of the endometrium, or it may be due to the liberation of the ovarian hormone by the destruction of the corpora lutea.

Shumway¹⁵³ states that the most effective treatment for that refractory condition—*vernal conjunctivitis*—is by means of radium. He reports 4 cases in which most satisfactory results were obtained.

Salicin. Watson¹⁵⁴ recalls that in the great pandemic of *influenza* in 1889–1890 he used salicin with excellent results. At that time he gave the drug in 30- to 60-grain doses every two or three hours, or, if the onset was at night, a heaping teaspoonful in cold water at bedtime. Since that time he has employed the drug in sporadic cases.

In the recent epidemic he found the drug equally useful, but, unfortunately, the crude salicin of the earlier days has been replaced by a purified salicin which is very expensive and obtainable in only small quantities. The purified form, when he was able to obtain it, gave the same results as the crude drug used in the earlier epidemic.

Salicylates. For years the salicylates have been employed in the treatment of *acute rheumatic fever* and it has been quite generally accepted that they were, in a sense, specific for this disease. In a study on the effects of the salicylates in rheumatic fever, Hanzlik, Scott and Gauchat¹⁵⁵ concluded that if you eliminate the elements of time, rest,

¹⁵² Minnesota Medicine, March, 1919.

¹⁵³ Pennsylvania Medical Journal, September, 1919.

¹⁵⁴ American Medicine, November, 1918.

¹⁵⁵ Journal of Laboratory and Clinical Medicine, December, 1918.

and natural recovery, it appears that the relief of later symptoms is brought about more effectively and permanently by salicylates than by combinations of drugs, whose pharmacologic actions are similar, but different chemically. They believe that the salicylates possess no thoroughly demonstrated specific action in rheumatic fever but are to be regarded as remedies which can be administered safely in very large doses. Under these circumstances they represent a fortunate combination of both antipyretic and analgesic qualities which make them more desirable for the treatment of rheumatic fever than combinations of opiates, and various antipyretics.

The authors also believe that while the promiscuous and unwarranted use of the drug is not without danger to the kidneys, its desirability and efficiency as a symptomatic remedy may be regarded as outweighing the seriousness of these disturbances.

POISONING FROM METHYL SALICYLATE is not a common occurrence. Rosenbloom and Johnston¹⁵⁶ in reporting a case, state that they found references to 6 cases in the literature in which this accident occurred; of this number, 4 ended fatally.

The case observed by them was that of a woman, aged forty years, who took an ounce of oil of wintergreen, thinking it was liquid petrolatum; about twenty minutes later she experienced a burning sensation in the abdomen and extreme nausea. She vomited, the vomitus consisted of oil of wintergreen. Almost immediately following this diarrhea occurred accompanied by a burning sensation. She developed tinnitus aurium half an hour after taking the oil. When seen two hours after the ingestion of the drug the pulse was 120 and weak. The nausea and vomiting continued for six days.

On the seventh day the temperature was normal and the patient's condition good except for fatigue and a sensation of her head falling into space. The urine showed 1.3 parts of albumin to the liter, and gave positive reactions for acetone and diacetic acid. From this time on the patient's condition was normal. The acetone and diacetic acid disappeared on the twelfth day of her illness, and the albumin on the seventeenth day.

Serum. A study of *serum disease* has been made by Davidson.¹⁵⁷ He distinguishes three types of rash which differ from each other in the following particulars: (1) In their clinical appearances and manifestations; (2) in their relative frequency of occurrence; (3) in their minimum and maximum incubation periods and in the length of the interval of time between these two points; (4) in their average incubation periods; (5) in their order of occurrence; (6) in the character and course of their graphs; and (7) in their duration.

The relative frequency of the three types is: (1) the urticarial, (2) the morbilliform and (3) most infrequently the circinate. The most important accompanying symptoms are pyrexia, joint pains, edema, enlarged lymph nodes and an increase in the area of cardiac dulness. Davidson believes that the various types of eruption suggest that the cause of

¹⁵⁶ Journal of the American Medical Association, January 4, 1914.

¹⁵⁷ Glasgow Medical Journal, July, 1919.

each type of rash is a different one. The distinction between the three types of rashes becomes even more marked in an investigation of some of the accompanying symptoms of serum disease and the theory that the causal factor in each type is not the same but of different origin is considerably strengthened.

In order to avoid producing *acute anaphylactic shock*, Lewis¹⁵⁸ recommends that when immune serum must be given intravenously it should be administered slowly and in a diluted form, the Woodyatt pump serving as an excellent means of doing so. The exact quantitative relations must be worked out experimentally with patients. At present, it can only be said that the injections should be made as slowly and the dilutions as high as is convenient or necessary under a given set of directions.

In regard to the administration of *antipneumonic serum*, Camac¹⁵⁹ gives the following instructions: To desensitize: (a) Administer 2 c.c. of serum subcutaneously and at two hours' interval administer the following amounts: 3 c.c. and 5 c.c.—a total of 10 c.c. After each administration look for signs of hypersensitiveness, such as: (1) Difficulty in respiration; (2) cyanosis; (3) violent coughing; (4) sense of constriction about the chest; (5) marked variation in the pulse. In case these occur, give same dose as previous one at the end of ten hours' interval. (b) From two to four hours after the last desensitizing dose, administer the balance of the 100 c.c. intravenously. (c) Administer 100 c.c. intravenously every twelve hours. The intravenous administration of serum, warmed to body heat, should be by gravity, and very slowly. In case of hypersensitiveness, as noted above, occurring during the administration of serum, stop the serum at once.

Serum sickness is not a serious condition and does not contra-indicate the continued administration of serum, though it is due to the serum. The manifestations of serum sickness are fever, itching and redness of the skin and urticaria. The condition is entirely different from true anaphylaxis, which in mild form would be manifested by the symptoms of hypersensitiveness noted above, and which, in severe form, may be rapidly fatal.

DIPHTHERIA. The importance of administering diphtheria antitoxin in suspected cases of diphtheria is emphasized by Carey.¹⁶⁰ He deplors the frequent practice of waiting for a laboratory report before administering the antitoxin. It should be a rule that any person suspicious enough to need a culture should have antitoxin given at the time the culture is taken. In an analysis of 1000 deaths, he states that one factor which stands out demanding comment is that 7.6 per cent. of the deaths occurred in unrecognized cases. In view of the excellent laboratory facilities available in nearly all communities, there can be no excuse for this. Another deplorable fact is that 11.8 per cent. of the cases were found moribund upon visitation by the physician. There is evidence for the necessity of awakening people, through educational methods, of their responsibility to their children.

¹⁵⁸ Journal of the American Medical Association, February 1, 1919.

¹⁵⁹ American Journal of the Medical Sciences, December, 1918.

¹⁶⁰ Boston Med. and Surg. Jour., January, 1919.

The dosage of antitoxin was extremely varied in amount, the number of doses given, and the interval between dosage. In 29 instances it was found that less than 3000 units were administered. The amount increased from this to a point where a young child three years of age received 225,000 units. The usual doses, however, seem to have been from 6000 to 9000 units. The number of doses varied from one to several on consecutive days, and in a few instances it was administered every four hours until death occurred. In one instance 80,000 units were given in this manner.

It is worthy of comment that in no instance did Carey find that the antitoxin was given intravenously. It is now an established fact that this method of administration is a safe procedure and Carey urges that it be adopted in those cases which are seen late in the disease.

He urges, in view of the lack of uniformity of using the antitoxin, that the medical profession be informed of the proper procedure and the dangers, through misuse, either in dosage or method of administration. Particular stress should be laid, in the instruction of medical students, upon the necessity of properly administering antitoxin, thus avoiding the chances for anaphylactic reaction and impressing upon them the needs of early and sufficient treatment.

Hoynes¹⁶¹ states that in his experience the following dosage is satisfactory: (1) Purely tonsillar cases, from 5000 to 10,000 units; (2) laryngeal, 10,000 to 15,000 units; (3) pharyngeal (including tonsils), 15,000 to 25,000 units; (4) nasal or nasopharyngeal, 20,000 units to 50,000 units. He points out that a child who has been ill for four days certainly demands a larger dose of antitoxin than one who has been sick but a single day. The longer the process has been present, the more the toxin absorbed, therefore the more antitoxin is needed to counteract it.

Hoynes urges that, if possible, the maximum amount of antitoxin required for a given case should be administered as soon as determined. In his opinion nothing is gained by a division of the dose—by repeated small doses—whatever is required is required at once.

Hoynes states that the subcutaneous route of administration is being superseded, in hospitals at least, by the intramuscular method. The serum may be injected into the gluteal muscles or those at the outer side of the thigh.

He points out that while the intravenous method is the ideal one, the following facts should be kept in mind: (1) It is unsafe to attempt such a procedure outside a hospital; (2) it is often impossible to insert a needle into a vein of small caliber without dissecting down upon it; (3) shock following the injection is frequently very severe, with alarming symptoms of collapse; and (4) should a case which has received antitoxin intravenously not survive, there is sure to be a feeling in some quarters that the physician is wholly responsible for the outcome. If the serum is administered intravenously, it should be warmed to the body heat and five to ten minutes should be consumed in injecting from 5000 to 10,000 units. Additional antitoxin, 10,000 to 20,000 units, may be given intramuscularly at the same time if it seems advisable.

¹⁶¹ Archives of Pediatrics, September, 1918.

Finally, Hoyne urges the general use of *toxin-antitoxin* (T. A.) for establishing an active immunity against diphtheria. The method is briefly as follows: One unit of antitoxin, combined with the amount of diphtheria toxin which this one unit will neutralize, is put up aseptically in a sealed glass ampoule. Three such ampoules constitute a prophylactic dose of establishing an active immunity. The contents of one ampoule, 1 c.c., is injected subcutaneously under aseptic conditions at intervals of from five to seven days. There may, or may not, be any constitutional reaction following the injections. The same holds true in regard to local reactions. When reactions occur, they are seldom as severe as sometimes seen with the antityphoid vaccine. At present the same quantity of T. A. is generally injected regardless of the patient's age.

It is to be borne in mind that this method is in no sense a substitute for diphtheria antitoxin, when an immediate immunity is demanded following exposure. It ordinarily requires from three weeks to three months for the active immunity to be established, but, when established, the immunity is believed to endure for from eighteen months to several years, and possibly for life; on the other hand, we know that the average immunizing dose of diphtheria antitoxin is only protective for from ten days to three weeks, on the average. Another point is that individuals with a negative Shick test are already immune, and this method is not indicated. Those with a positive Shick test should receive this immunizing treatment.

The use of toxin-antitoxin mixture is also urged in an article in the *California State Journal of Medicine* for May, 1919. It urges that those who are found susceptible by the Shick test should be immunized by toxin-antitoxin which is as effective as typhoid vaccine against typhoid fever. The injection of this mixture is harmless, even in infants. One injection immunizes 80 per cent. of susceptibles; two injections immunizes 90 per cent., and three injections 97 per cent. Immunity lasts for at least three years.

As it is impracticable to diagnose diphtheria carriers on a large scale by means of cultures, identification of susceptibles by the Shick test and immunization by means of T. A. is the method to be followed.

DYSENTERY. In cases of true bacillary dysentery Lantin¹⁶² has had considerable success with the use of serum. The serum may be administered intramuscularly, intravenously or by rectum. Of 20 positive cases, 5 were treated medicinally, combined with intramuscular injections of serum, with 1 death; 6 patients were given the serum intramuscularly, with no deaths; 3 received the serum intramuscularly and by rectum with no mortality, and 3 patients each were given the serum intravenously and by rectum with no deaths.

Lantin recommends the following procedure for rectal administration: The patient is placed in the knee-chest position and the injection of serum preceded by a cleansing enema of 1.5 per cent. solution of sodium bicarbonate. This is followed by another enema of starch solution with a few drops of tincture of opium (60 c.c. with 10 drops of tincture of

¹⁶² Philippine Journal of Science, September, 1918.

opium) to diminish the irritability of the intestine. A half an hour later the serum is given by rectum. The amount of serum used varies from 30 to 50 c.c. daily, depending on the severity of the case, although the serum can be given frequently without any danger and in larger doses.

Intramuscular injections to the amount of 20 c.c. are given twice a day, in the buttock. Intravenous injections are given in the usual way. Lantin gives 10 c.c. every other day. To avoid anaphylactic shock 1 c.c. of the serum is injected intravenously about six hours before the full dose is given.

GAS BACILLUS INFECTION. The treatment of this condition by means of serum is considered by Van Beuren¹⁶³ who reviews the literature on the subject. In regard to use of serum in the treatment of wounds, he quotes Elser as advising the following procedure: (1) A prophylactic dose of polyvalent serum, given as early as possible after the receipt of the wound, combined with tetanus antitoxin. (2) Bacteriologic examination of the wound and establishment of the presence of gas bacillus infection and determination of the variety of the bacteria. The determination may be made in about twenty-four hours. (3) Administration of specific serum, either single or polyvalent or "pooled," according as there are one or more gas-formers found and also antistreptococcus serum. Van Beuren feels that the encouraging results incline one to feel that future improvement in the results of treatment for gas bacillus infection will rest on preventive and curative serotherapy, as well as on the observance of the correct operative procedure and on earlier operation.

CEREBROSPINAL MENINGITIS. In reporting his experience in the use of antimeningococcic serum, Seham¹⁶⁴ states that in the premeningitis stage, if the spinal fluid is clear, the serum may be used intramuscularly or intravenously, preferably the latter, but if signs of meningeal irritation have developed, the intraspinal method alone, or combined with either of the other two must be used. The general rule to be followed was to give the serum daily for five days, and then, if the fluid was clear, and the general condition of the patient much improved, the serum was discontinued. The minimum number of injections to one patient was two, the largest number forty-four, and the average number seven.

As the serum has never been standardized, there is no way of measuring its potency. The average dose he employed for children was 15 c.c., providing that 15 c.c. of spinal fluid had been removed. In adults, 30 c.c. was the amount usually given, although if excessively large amounts of spinal fluid have been removed as much as 45 c.c. may be given. If a dry tap was obtained, or only a few drops of fluid were removed, between 5 and 10 c.c. of serum were given.

Seham believes that the spinal administration of serum is to be considered as a major surgical operation and the patient closely watched for signs of collapse. The respirations, especially, should be watched, and at

¹⁶³ Journal of the American Medical Association, July 26, 1919.

¹⁶⁴ Minnesota Medicine, October, 1918.

the first sign of collapse, either camphorated oil or cocaine and atropine should be given hypodermically. If respiration ceases artificial resuscitation should be employed. At the same time the tube containing the serum should be lowered, in order to allow the serum and spinal fluid to flow out. In his earlier cases he employed a syringe, but, as the result of a death, he adopted the "gravity" method. Very frequently the patient will complain of severe pains in the back, legs and head, sometimes at the beginning of the injection but usually afterward. The pain may be very severe and last for some time.

In regard to the time to discontinue the serum, the character of the spinal fluid should be watched. At the onset of the disease the spinal fluid is nearly always cloudy, contains many extracellular organisms and many pus cells, and is under increased pressure. Usually at the end of five daily injections of serum the fluid clears up, the organisms disappear, and there are few pus cells or none at all. At the same time the patient's mental condition improves, the temperature drops, and the rigidity of the neck and extremities decreases. The serum should be discontinued under these conditions. After this a lumbar puncture, for a period of another week, should be done upon alternating days, to see whether the fluid remains normal. Even though clinical signs have improved, if the fluid should become cloudy again and pus cells and organisms return, the serum should be immediately readministered. If one is uncertain, the patient should always be given the benefit of the doubt, by the injection of serum. The fluid clears up, on an average, about the tenth day.

PNEUMONIA. The tremendous incidence of pneumonia, the so-called *influenza pneumonia*, which prevailed last autumn and winter, naturally led to many innovations in treatment. In view of the fearful mortality the disease exacted, this is not surprising. One method of treatment which excited much interest and controversy was the use of *convalescent serum*. The claims of McGuire and Redden¹⁶⁵ in particular, have led to a great deal of discussion on the subject. While convalescent serum has been used in three types of pneumonia it is the so-called influenza pneumonia in which it has been most widely employed. The following procedure has been recommended for obtaining the serum:

I. Selection of Donors.

A. Donors must be known convalescents from influenza-pneumonia. This is indicated by history sheets showing—

- (a) Temperature—fever for more than four days.
- (b) Leukocyte count—not over 10,000.
- (c) History of physical findings.

B. A Wassermann test must be done and must be undoubtedly negative.

C. Donors must have completed at least ten days of convalescence with a normal temperature and not have exceeded thirty days from beginning of convalescence.

¹⁶⁵ American Journal of Public Health, October, 1918; Journal of the American Medical Association, March 8, 1919.

II. Selection of Patients.

A. Serum should not be given to any patient who has not developed influenza-pneumonia.

B. To be most efficacious, the serum must be given early. It is practically useless in late or moribund cases.

C. No serum should be given unless the patient will agree to furnish some blood in return for that given.

D. No serum should be given to those patients presenting a white count of over 10,000 or having a fixed type of pneumococcic sputum.

III. Collection of Blood from Patients.

A. Sufficient blood for a Wassermann test should be taken at the time of administration from each case receiving serum. This specimen should be sent for examination at once.

B. Blood should not be taken before the tenth day of convalescence. Not over 500 c.c. should be taken at one time.

C. The patient should not be bled more than twice, and at least forty-eight hours should elapse between bleedings.

The dose of serum, as recommended by McGuire and Redden, varied from 75 c.c. to 125 c.c. intravenously and the interval between doses varied from eight to sixteen hours. The treatment is continued until there is no doubt about the recovery of the patient. The majority of patients received about 300 c.c. Results from the serum were noted, as a rule, in the first twenty-four hours after its use. If no results were obtained in this time, the serum from another donor should be used. McGuire and Redden noted that at least 10 out of 70 serums had no effect on patients.

The authors state that out of 151 patients with bronchopneumonia following influenza treated by human convalescent serum, 3 died without complications and 3 died after a complicating hemolytic streptococcus empyema making a total of 6 deaths, or 4 per cent.

Stoll¹⁶⁶ in reporting 56 cases treated by this method expresses the belief that the early employment of convalescent serum appears to be a therapeutic measure of definite value.

In view of the mortality experienced by others in dealing with this condition these results attracted a great deal of attention. Unfortunately, they have not been substantiated by others. Gould¹⁶⁷ while expressing the belief that the human serum from convalescents undoubtedly contains valuable antibodies, the present limited ability to isolate the infecting organisms of the donor and the recipient prevents its general application. Furthermore, the method cannot be used except in large, well-equipped hospitals where access can be had to many willing donors. And, I may add, it is doubtful if one can obtain the same willingness of donors in a civil hospital where conditions are entirely different from those obtaining in a military hospital such as McGuire and Redden had.

There is still a good deal of uncertainty about the value of serum and

¹⁶⁶ Journal of the American Medical Association, August 16, 1919.

¹⁶⁷ New York Medical Journal, April, 1919.

vaccines in influenza. The situation is admirably expressed in an editorial article.¹⁶⁸

"With respect to serums and vaccines in influenza, there are certain simple facts and considerations that physicians will do well to keep in mind at this time. The main point to keep always in sight is that unfortunately we as yet have no specific serum or other specific means for the cure of influenza, and no specific vaccine or vaccines for its prevention. Such is the fact, all claims and propagandist statements in the newspapers and elsewhere to the contrary notwithstanding. This being the case, efforts at treatment and prevention by serums and vaccines, now hurriedly undertaken, are simply experiments in a new field, and the true value of the results cannot be predicted by any one. Indeed, the exact results can be determined if at all only after a time, in most cases probably not until the epidemic is past and all the returns fully canvassed. Consequently the physician must keep his head level and not allow himself to be led into making more promises than the facts warrant. This warning applies especially to health officers in their public relations."

Several reports have appeared on the use of *antipneumococcus serum* in the treatment of *lobar pneumonia*. Hart¹⁶⁹ has analyzed 121 cases of lobar pneumonia. Serum was administered to 31 patients showing the Type I organism. While his evidence is fragmentary, he believes it indicates that the administration of the serum affords a definite aid to nature's effort to sterilize the blood stream. Camac¹⁷⁰ also believes that the early administration of the serum prevents the development or clears the blood of pneumococcus organisms. Hart states that the failures from the use of the serum are instructive. In each instance there was a localized focus of infection which continued to furnish pneumococci to the blood stream. In one instance this was an empyema; in three others an acute endocarditis was present, and in two of these, which were examined postmortem, there were found on the heart valves fresh vegetations containing pneumococci.

Kyes¹⁷¹ compares 115 cases of lobar pneumonia treated with antipneumococcus serum with 538 similar cases of pneumonia occurring in the same institution during the same period, but not so treated. Of the 538 patients not treated with serum, 244 died, a mortality of 45.3 per cent. Of 115 similar patients treated with serum, 24 died, a mortality of 20.8 per cent. In the ward in which the serum was employed, the death-rate during the six weeks prior to the introduction of the serum was 55 per cent. and during the six weeks subsequent to the withdrawal of the serum treatment, the death-rate was 51 per cent. Kyes believes that these figures show pretty conclusively that the antipneumococcus serum is of distinct value.

Cecil¹⁷² reports gratifying results in 20 cases of Type I pneumonia treated with Type I antipneumococcus serum. Of these 20 cases, only 2 died, and 1 of these was complicated by scarlet fever and acute neph-

¹⁶⁸ Journal of the American Medical Association, October 26, 1918.

¹⁶⁹ Medical Record, May 31, 1919.

¹⁷⁰ American Journal of the Medical Sciences, December, 1918.

¹⁷¹ Journal of Medical Research, July, 1918.

¹⁷² New York State Journal of Medicine, October, 1918.

ritis. In addition to the Type I cases, 35 other cases of pneumonia, including all types, were treated with a polyvalent antipneumococcus serum. As 13 of these 35 cases died (37 per cent.) the use of this serum was abandoned as it probably was doing more harm than good.

In the cases treated by Camac,¹⁷³ he states that about 50 per cent. showed signs of serum reaction. The reactions ranged from simple erythema to the extensive urticaria with general swelling and joint pains. Some of the severer cases developed after 50 c.c. of serum had been given and others showed no reaction after 400 to 600 c.c. Manifestations appeared from twelve hours to fourteen days after the administration of the serum. Only 2 cases showed any alarming symptoms and only 1 case presented symptoms of anaphylaxis.

POLIOMYELITIS. Nuzum¹⁷⁴ belongs to the Rosenow School which believes acute anterior poliomyelitis is due to a streptococcus. He claims that antipoliomyelitic horse-serum, prepared by repeated injections of the coccus isolated from the central nervous system in human and monkey poliomyelitis possesses neutralizing properties against the virus of poliomyelitis. He states that the neutralizing, protective, and curative properties of antipoliomyelitic horse-serum for experimental poliomyelitis of monkeys are in direct accord with the favorable results obtained in the serum treatment of human poliomyelitis and argue strongly for the etiological relationship of the coccus to their disease.

In another article, Nuzum¹⁷⁵ gives the results obtained in 159 patients treated with antipoliomyelitic serum.

1. Of 159 patients receiving serum in all stages of the disease, 19 died, a mortality of 11.9 per cent. Among 100 cases occurring during the same period of time, in which the patients did not receive serum, 38 patients died, a mortality of 38 per cent.

2. He has treated 152 patients in all stages of infantile paralysis, excluding 7 cases presenting respiratory paralysis on admission, with 11 deaths—a mortality rate of 7.2 per cent. During the same period of time a total of 301 cases were reported to the health department with 97 deaths—a mortality of 32 per cent.

3. This series of treated cases suffices to demonstrate the harmlessness of serum treatment when the serum is free from hemoglobin, sterile to repeated cultures, and the injections are slowly made and all known rules of precaution are observed.

4. The serum appears to possess the power of definitely preventing the onset of paralysis when administered early in the disease. In ten undoubted instances of poliomyelitis in which no paralysis was detected at the time serum was administered, prevention of paralysis and complete recovery resulted in 100 per cent.

5. The action of the serum is more definite in arresting the extension of paralysis and diminishing the severity than in effecting its disappearance.

6. As in other acute infectious diseases, the earlier the serum is administered, the more striking are the results obtained.

¹⁷³ Loc. cit.

¹⁷⁴ Journal of Infectious Diseases, September, 1918.

¹⁷⁵ Journal of Iowa State Medical Society, July, 1918.

7. Serum should be injected intraspinally in small doses and at the same time intravenously in larger amounts. The temperature has been employed as a guide to the dosage.

8. The injection of serum is followed by a critical fall in the patient's temperature. Coincident with this, there occurs a slowing of the pulse-rate, and usually other definite clinical evidence of general improvement.

9. In doubtful early cases the decision to use serum should rest on the bacteriologic, chemical and microscopic examination of the cerebrospinal fluid.

STREPTOCOCCIC INFECTION. In addition to the usual local applications and general symptomatic treatment of *erysipelas*, Hux¹⁷⁶ employed a polyvalent antistreptococcic serum. He states that 75 per cent. of his cases were favorably influenced. Amelioration of the symptoms was too closely connected with the administration of serum to be explained on any other basis. In the majority of cases following the administration of serum there was a fall in the temperature, pulse-rate and respiration, followed in a few hours by a slowly rising temperature, which, however, usually did not reach its original height.

TETANUS. According to Bazy¹⁷⁷ we have learned the following facts regarding tetanus as the result of the war: (1) That preventive injections are efficacious in the immense majority of cases. (2) When the serum acts incompletely, it so modifies the course of tetanus that it has created new forms of the disease, unknown before its use was general. (3) The study of the check to serotherapy ought to lead (a) to the use of the serum in a more rational way; and (b) to know how to complete its action by that of an antitetanic vaccination.

Of all the methods of administering the serum, Bazy believes that but one alone is to be followed, namely, the subcutaneous.

Bazy has employed as vaccine an iodized toxin, the same as is used at the Pasteur Institute to prepare the horses providing serum. On mixing the toxin with an iodized solution (iodine 1 gm., iodide of potassium 2 gms., and distilled water 200 gms.) in the proportion of two-thirds of toxin to one-third of iodized solution, there is obtained a liquid neutral for the organism, but yet capable of vaccinating it. The first time he injects 4 c.c. of iodized toxin, the second time 8 c.c., and the third time 12 c.c. The number and the amount of these vaccinal injections may be further increased. Bazy states that they are borne remarkably well and provoke neither local nor general phenomena.

Gessner,¹⁷⁸ in writing on the use of antitetanic serum from the standpoint of the surgeon, states that all victims of accidental injury, of a punctured, lacerated, crushes or gunshot character, especially when associated with foreign bodies or with exposure to street, garden, or stable contamination, should receive 1500 units of antitetanic serum at the first treatment. All patients of this type coming secondarily under observation should receive the serum, though several days may have elapsed. If in this class of patients suppuration continues the adminis-

¹⁷⁶ Journal of Cutaneous Diseases, June, 1919.

¹⁷⁷ Lancet, October 19, 1918.

¹⁷⁸ Journal of the American Medical Association, September 14, 1918.

tration of the serum should be repeated at intervals of ten days, as there is reason to believe that its protective influence does not last beyond this time.

Treatment should be by large doses of serum, of not less than 10,000 units to the dose. Administration by the intravenous, intraneural, intramuscular and subarachnoid methods should be more extensively employed for the purpose of bringing out their value more thoroughly. Patients coming under treatment for tetanus should be isolated in quiet, comfortable rooms, under the care of surgeons and nurses interested in their treatment and confident of improving on fast results by devoted attention. Food and water, skin cleansing, the care of the bowels and the use of sedatives to calm anxiety and relieve pain must all receive the closest attention.

Sodium Bicarbonate. The fact that such a wide variety of substances have been advocated for the treatment of *burns* is fairly good evidence that none of them are entirely satisfactory. In addition to the usual methods of reducing pain and overcoming shock, McDonald¹⁷⁹ has found that in the first aid care of extensive burns the dressing with gauze soaked in 10 per cent. or stronger sodium bicarbonate and kept moist, is the simplest method and gives the greatest comfort. As soon as possible and at least within thirty-six hours, paraffin dressings should be used.

Recently I have had my attention called to the use of bicarbonate of sodium for the relief of *sunburn*. My informant, a layman, was suffering severely from badly burned arms acquired while in bathing. He found that by moistening the affected surface and then powdering over it bicarbonate of sodium, which was allowed to dry, the burning sensation and tenderness were quickly relieved.

The production of *tetany* by the intravenous infusion of sodium bicarbonate is reported by Harrop.¹⁸⁰ The bicarbonate was administered to a woman who had swallowed a tablet of bichloride of mercury and whose plasma carbonate capacity was greatly reduced. She was given 500 c.c. of a 5 per cent. sodium bicarbonate solution intravenously; no untoward effect occurred and the patient stated that she felt more comfortable. Twenty-four hours later 700 c.c. of a 5 per cent. solution were given. This made in all 60 grams of sodium bicarbonate. About five minutes after the last infusion, which had been given slowly and had been apparently well taken, the patient's face suddenly grew pale. She commenced to have great inspiratory distress and became very apprehensive. She also complained of numbness and tingling in the fingers, and begged to have them rubbed. The hands assumed the typical obstetrical position; there was pedal spasm, and Chvostek's sign (spasm of facial muscles). The pulse was accelerated and the extremities cold. The acute attack lasted about fifteen minutes, after which the breathing became easier and the apprehension less marked. The obstetrical position of the hands persisted for about two hours. On the following day Chvostek's sign was more marked and Trousseau's phe-

¹⁷⁹ Annals of Surgery, March, 1919.

¹⁸⁰ Bulletin of the Johns Hopkins Hospital, March, 1919.

nomenon was easily elicited. The latter persisted for four days and the former for seven days, when the patient died.

In this connection attention may be called to the *relationship between tetany and alkalosis*. McCann¹⁸¹ considers that there is some relationship between alkalosis and gastric tetany. Experimentally, he has observed that following operations on the stomach which exclude the acid secreted from the duodenum, tetany develops accompanied by an increase in the carbon dioxide combining-power of the plasma similar to that of parathyroid tetany. Administration of acid intravenously, or through the duodenum, produced favorable responses toward more normal conditions. He interprets gastric tetany as a condition of alkalosis, in which a disproportion between the rates of secretion of acids and alkalis by the gastro-intestinal tract may be a factor. Clinically, gastric tetany is most apt to occur in those cases in which there is some pyloric obstruction.

Of recent years a great deal of work has been done on the subject of *acidosis*. In addition to its occurrence in diabetes, it is now believed to be associated with a variety of conditions. A note of warning is sounded by Hare¹⁸² who believes that perhaps the condition, or rather the term, is being too widely applied, and that it is associated with many diseases without any very good proof that such is actually the case. The symptomatology of acidosis is not always definite and in many instances the symptoms are only suggestive. Among the early symptoms are restlessness, sleeplessness and excitement to be followed later by somnolence, prostration and coma. The only certain symptom, aside from the laboratory tests, is hyperpnea. This consists of deep exaggerated inspirations and expirations, somewhat increased in rapidity and constantly present. This symptom may be only slightly present or may be severe enough to constitute air hunger, without there being discoverable any organic or functional disturbance of the heart or lungs to account for it, and without cyanosis.

In the *treatment* of acidosis, Griffith¹⁸³ advises the free administration of alkali, especially bicarbonate of soda, and enough should be given to keep the urine alkaline. The salt may be given by the mouth, or, if vomited, by the bowel, or still better intravenously.

Whitney¹⁸⁴ points out that the neutralization of acid ions by means of alkalies is not the only thing to be considered in the treatment of acidosis. If excretion is so poor as to allow acidosis to develop, it is probable that the alkalies will also accumulate, and possibly to a highly dangerous concentration in the blood and tissues unless elimination is free. Diuresis should therefore be promoted by giving large quantities of fluid by mouth, under the skin or perhaps best by Murphy's drip method of continuous rectal injection. Fresh air should be provided in the form of a gentle breeze across the face to prevent the rebreathing of carbon dioxide, which may prove the last straw to the overloaded

¹⁸¹ Journal of Biological Chemistry, 1918, xxxv, 553.

¹⁸² Therapeutic Gazette, 1919.

¹⁸³ Ibid., July, 1919.

¹⁸⁴ British Medical Journal, May 11, 1918.

respiratory center. Morphine, which is well known to be a respiratory depressant, must be used with great caution.

The influence of sodium bicarbonate on curd formation has been investigated by Bergeim, Evvard, Reh fuss and Hawk¹⁸⁵ in an extensive study they have made on the gastric response to foods. They found that the addition of $2\frac{1}{2}$ grams of sodium bicarbonate to 500 c.c. of raw, whole milk caused the formation of curds which were smaller and softer than those produced in similar milk in the absence of bicarbonate. There was a definite curd formation at five minutes, although the stomach contents remained alkaline for thirty minutes. That the bicarbonate treatment was not as effective as was boiling in producing soft curds was shown by the fact that the curds of the boiled whole milk were smaller and softer than were the curds in the milk after bicarbonate had been added. The boiled milk also left the stomach sooner than the bicarbonate milk.

Sodium Citrate. The widespread prevalence of *pneumonia* during the past two winters has naturally led to a number of suggestions as to treatment. Weaver¹⁸⁶ reports 36 cases of the disease treated with sodium citrate. He believes that those who have tried the drug test and have been disappointed, have not used it in sufficient dosage or long enough.

In an adult he advises giving from 40 to 60 grains every two and a half or three hours, day and night, until the lung has cleared. If the citrate is discontinued before complete resolution is established there will be an immediate relapse, but this will again clear away under the renewed use of sodium citrate.

The drug may do no harm but it is not clear as to how it does good. As we have so frequently stated in regard to the use of the various remedies recommended for croupous pneumonia, it must be borne in mind that the disease varies greatly in severity from year to year and even in the same year. It is always possible that one may be dealing with a group of cases infected with the relatively non-fatal Type IV organism. In such instances any drug apparently produces excellent results.

Sodium Hyposulphite. This drug has been highly recommended by Huchard in the treatment of *respiratory diseases*. Iarcho¹⁸⁷ has used it extensively and has been greatly impressed by its beneficial effect on the cough and expectoration, especially in those cases with purulent sputum. He states that it is non-toxic and has no by-effects except possibly, a slightly laxative action.

The usual dose is 2.5 or 3 gm. a day for adults and 1 gm. a day for children five years of age. It is best given in hot, slightly sweetened water. The drug is incompatible with the salts of lead, silver, mercury and iodine.

Sparteine. Iyer¹⁸⁸ believes that this drug is the most efficient heart tonic we have in the treatment of *pneumonia*. It reduces the frequency

¹⁸⁵ American Journal of Physiology, May, 1919.

¹⁸⁶ New Orleans Medical and Surgical Journal, October, 1918.

¹⁸⁷ Semana Medica, November 21, 1918; Abstract, Journal of the American Medical Association, March 15, 1919.

¹⁸⁸ Indian Med. Gaz., December, 1918.

and increases the force of the heart's action, but instead of contracting the bloodvessels and increasing arterial blood-pressure, it has directly the opposite effect. This dilatation of the capillaries by reducing the blood-pressure will relieve the heart of its burden, thus enabling it to handle the volume of blood without laboring and to throw an ample current to the lungs, where the improved capillary circulation could promote abundant oxygenation. An additional advantage it possesses in Iyer's opinion is that it acts promptly when given hypodermically, its effects being well established within an hour, and lasting from six to twelve hours.

Strychnine. In an experimental study of the effect of drugs on hunger Ginsburg and Tumpowsky¹⁸⁹ state that as widely employed as strychnine is for its tonic value, there has been no experimental evidence for its supposed gastric effect. With doses of $\frac{1}{90}$ to $\frac{1}{60}$ grain subcutaneously they found that the stomach tonus was increased, but at the same time the general excitability of the animal was increased so that the increased height of the writing level may have been due to the increased tonus of the abdominal muscles. At the same time, however, there appears to be a definite increase in the hunger contractions themselves.

It has been asserted by Dr. Paca that repeated doses of strychnine are of value in the diagnosis of *malaria* by increasing the number of parasites in the peripheral circulation. Recognizing that this observation, if true, would be of great service in the study of malaria and of malarial relapse King¹⁹⁰ tested it. He found that strychnine in large doses (20 or 30 minims of liquor strychninae hydrochloridi, B. P., in five hours) will in half of the cases definitely contract a large spleen, but have no appreciable action on small spleens. In most cases the drug does not increase the number of parasites in the peripheral circulation. Hence, as a routine aid to diagnosis, strychnine has no place. He suggests, however, that the blood-pressure-raising group of drugs, such as strychnine, might be tried in the treatment of malaria in the early, as well as the late, stages as an adjuvant to quinine.

Styptics. There is no emergency for which the patient is more insistent for relief than hemorrhage from whatever source. To be confronted with hemorrhage which is inaccessible and fails to respond to treatment is distressing for the patient and discouraging to the physician. Nearly all of the reputed styptics have been tested by Hanzlik.¹⁹¹ As a result of his experimental work, it may be stated that in general the local application of vasoconstrictor and astringent agents diminish or arrest local hemorrhage, while vasodilator and irritating agents (without astringent action) increase local bleeding. Some of the newer styptics such as kephalin or tissue extracts are still of uncertain value. Hanzlik found that *adrenalin* is still the most efficient and desirable local hemostatic agent, but its action is temporary and it is not to be relied on for permanent hemostasis. Pituitary extract and tyramin are also efficient and possess this advantage over adrenalin, namely, that they do not

¹⁸⁹ Archives of Internal Medicine, November, 1918.

¹⁹⁰ Indian Journal of Medical Research, July, 1918.

¹⁹¹ Journal of Pharmacology, No. 71, xii, 191; *ibid.*, p. 119.

increase the bleeding later. He found the astringents as a class variably effective; the most efficient of this group are ferric chloride and tannin. The action of alum he found to be very disappointing.

Stypticin, styptol, antipyrine and emetine were found by Kanzlik to increase the bleeding on local application.

It is to be borne in mind that in many instances small local hemorrhages are rarely dangerous and in most instances stop of themselves; excepting, of course, known hemophiliacs in whom the most trivial hemorrhage is a source of danger because of its persistence. For instance there is the form of hemorrhage, namely, pulmonary due to tuberculosis, in which the bleeding is in most instances not dangerous of itself and rarely requires any treatment other than rest and possibly some morphine to allay the nervousness of the patient. And yet I know of no condition in which such heroic methods are frequently employed. A patient for instance, will have a small hemoptysis, amounting to an ounce or less. He is naturally frightened and this is not alleviated any when he is given various drugs, hypodermically and otherwise, an ice-bag over the chest, and possibly salt solution intravenously or by rectum. Furthermore, none of these measures do any good. Either the hemorrhage ceases spontaneously, which is the case in the majority of instances, or it recurs. In the latter type of pulmonary hemorrhage there are only two measures of any value whatever, namely, artificial pneumothorax or large doses of atropine hypodermically.

Thymol. This drug has gained its reputation as an anthelmintic largely through its use in the treatment of *hookworm disease*. McIntire¹⁹² has used it solely in the treatment of *tapeworm*. He recommends the following procedure: Absolute fasting for thirty-six hours, with a saline laxative at the beginning and end of the first twenty-four hours. At the expiration of thirty-six hours, 10 grains of thymol in capsules are given every hour until vertigo is produced. When this appears another saline is given and the patient is placed over a jar containing hot water. The amount of thymol required has varied in his experience from 30 to 60 grains. The length of the parasite varied from 15 to 66 feet.

The patients complained of nothing except vertigo and a sensation of heat and were able to follow their usual duties the next day. When given in 10-grain doses repeated hourly the danger of poisoning is small. The one caution is never to follow thymol by oil, as oil puts it in solution and allows too rapid absorption.

Thyroid Extract. In the treatment of *goitre*, with myxedema symptoms, Tracey¹⁹³ advises the use of not more than half a grain of desiccated thyroid a day at the beginning of the treatment. The patient should be watched for the least sign of trouble, such as pain in the thyroid, and on its appearance the medication should be stopped. This indicates that enough may have been given to awaken the dormant tissue to renewed activity. He reports the case of a woman, aged fifty-one years, who was melancholic and sleepy in the daytime. She had a moderate-sized goitre. A half a grain of desiccated thyroid was prescribed after each

¹⁹² Indianapolis Medical Journal, April, 1919.

¹⁹³ Endocrinology, April-June, 1918.

meal. After a week's administration of the thyroid extract the right lobe became painful and later reddened. The treatment was stopped. The mental condition cleared up rapidly after the administration of the extract.

Vaccines. There is still much to learn about the use of vaccines, especially those employed for curative rather than preventive purposes. Adamson¹⁹⁴ deprecates the still prevalent tendency to employ vaccines indiscriminately in all sorts of conditions, because we are not really in a position to know when we may do good and when we may do harm by this treatment. Furthermore, we have no means of estimating the effects in a person whose reactivity has been altered, perhaps profoundly altered, as the result of previous microbic infection.

ASTHMA AND HAY FEVER. It is becoming more and more the accepted belief that asthma is in the great majority of instances due to protein hypersensitiveness. This hypersensitiveness may be brought to light through the inhalation of certain substances, such as the pollen from plants, the exposure to animals, notably horses, or as the result of the ingestion of certain proteins or as the result of bacterial infection. In the treatment of hay fever, the first step is to determine the particular pollen or pollens at fault. This is done by means of cutaneous tests with solutions of the common pollens (such as rag weed, golden-rod, asters, etc.). The extract of the pollen or pollens to which the patient reacts is then used for immunizing purposes. Terry who has reviewed this subject carefully states that experience has taught that the average individual requires from ten to fifteen injections to produce the resistance necessary to insure against attack.

Walker has reported cases of bronchial asthma whose serums agglutinated strains of *S. pyogenes aureus* in a high titer and were treated with stock vaccines of this organism. Relief was obtained in the six patients so treated.

BOILS. Perhaps one of the most successful results from the use of vaccines is in the treatment of boils and allied infections. Womer¹⁹⁵ reports 100 cases treated with autogenous vaccines. Of these cases, 30 suffered from boils; in each instance he states the vaccine treatment was successful. Suppurative conditions affecting the ears were also successfully treated with autogenous vaccines.

INFLUENZA. The use of vaccines both as a preventive and a curative procedure in dealing with influenza has attracted a great deal of attention. During the recent epidemic many claims were made in favor of this method of treatment; it is to be borne in mind, however, that many of the reports favorable to this treatment appeared in the daily newspapers. Early in the epidemic two special boards were appointed to investigate the merits of the vaccines employed in influenza. Both reports were, on the whole, rather unfavorable to the treatment. At a time when sufficient experience had been gained as to the prophylactic value of influenza vaccination McCoy, Murray and Teeter¹⁹⁶ reported

¹⁹⁴ *Lancet*, August 10, 1918.

¹⁹⁵ *Pennsylvania Medical Journal*, December, 1918.

¹⁹⁶ *Journal of the American Medical Association*, December 14, 1918.

unfavorably on the procedure. They selected in each ward of the hospital all patients aged forty-one years or under, and each alternate patient was vaccinated, the remainder being considered as controls. Each group numbered 390. The vaccination was completed November 15, 1918, and fortunately the institution remained free from influenza until November 26, 1918, when cases began to appear, although at this time the epidemic had almost disappeared from the community at large. The cases were clinically like those observed elsewhere, and there was the usual percentage of severe cases and of cases with serious pulmonary complications, some terminating fatally. The following table shows the results obtained in the two groups up to December 9, 1918:

	Vaccinated.	Not vaccinated.
Persons in group	390	390
Number developing influenza	119	103
Number developing pneumonia	23	17
Deaths	10	7

They conclude that these observations are sufficient evidence that no protection was offered by the vaccine.

The vaccine contained the *B. influenzae*, *Streptococcus hemolyticus*, *Staphylococcus pyogenes aureus* and the four types of pneumococci.

In another communication, McCoy¹⁹⁷ reviews the results obtained by various observers from the use of various types of vaccines, some consisting of the *B. influenzae* alone, others consisting of several organisms. He concludes that the general impression gained from uncontrolled use of vaccines is that they are of value in the prevention of influenza; but, in every case in which vaccines have been tried under perfectly controlled conditions, they have failed to influence in a definite manner either the morbidity or the mortality.

PNEUMONIA. The results obtained by prophylactic inoculation against the pneumococcus in 12,519 men is reported by Cecil and Austin.¹⁹⁸ The men were vaccinated against pneumococcus Types I, II, and III. Three or four doses were given at intervals of five to seven days, with a total dosage of 6 to 9 billion of Types I and II, and 4½ to 6 billion of Type III. During the ten weeks that elapsed after the vaccination, no cases of pneumonia of these three types occurred among the men who had received ten or more injections of vaccine. For control purposes there were approximately 20,000 men, and among these there were 26 cases of pneumococcus Types I, II and III pneumonias during the same period. The authors therefore conclude that prophylactic vaccination against pneumococcus of Types I, II and III is practical and apparently gives protection against pneumonia produced by these types. It is uncertain, however, how long this immunity persists.

TYPHOID FEVER. In considering the value of prophylactic vaccination against typhoid fever in troops Brown, Palfrey and Hart¹⁹⁹ emphasize the fact that no false sense of security from typhoid vaccination

¹⁹⁷ Journal of the American Medical Association, August 9, 1919.

¹⁹⁸ Journal of Experimental Medicine, June, 1918.

¹⁹⁹ Journal of the American Medical Association, February 15, 1919.

should be permitted to relax vigilance in the observance of other preventive measures. They point out that in spite of vaccination occasional cases of typhoid fever will occur, most probably because of the ingestion of virulent organisms in massive doses. To eliminate such occurrences, sanitary precautions should prevail especially in the guarding of food and drink against contamination. Serious contaminations of the water supply and of milk on a large scale near the source can ordinarily be prevented by the efforts of sanitary officers, civil and military, working in coöperation. The contamination of water, ice, milk and food on a smaller scale by carriers among food handlers and flies, however, is a matter that demands more laborious and detailed attention. Success in the protection of latrines and in the control of flies is never absolute, but only relative and in proportion to the care devoted to the subject.

Especially important, in their opinion, is the supervision of food handlers, not only to insure cleanliness, but also by bacteriologic tests of each individual to exclude the admission of a carrier to any position from which he can contaminate the food or drink of his companions. It is needless to say that the same precautions are highly desirable among those in civil life. The havoc caused by cooks who are typhoid carriers is so well known that it needs hardly to be mentioned.

WHOOPING-COUGH. Luttinger,²⁰⁰ who has previously written of the value of the vaccine treatment of pertussis, reiterates his belief in its efficiency. When given in high doses and at the proper intervals he believes it is the best remedy we have for the prevention and cure of whooping cough. The negative reports, so far published, are based, he thinks, on insufficient data and should not have been allowed to pass uncensored by the authorities.

Bloom²⁰¹ states that no medicinal treatment is indicated, unless something unusual occurs, and then symptomatic treatment should be practised. The indications for the vaccine are: (a) A suspicious cough that does not respond to the ordinary treatment; (b) children who have been exposed and who have not shown symptoms of pertussis; (c) children exposed to whooping-cough and having some symptoms; and (d) in the presence of an epidemic. There are no dangers from its use.

Bloom concludes that vaccine therapy in pertussis is rational and effective. Experience has proved its efficacy both as a prophylactic and as an active therapeutic agent. By its use the loss in weight is minimized, the duration of the disease is shortened and it decreases the intensity of the illness. Furthermore, it forestalls the possibilities of complications and sequels, is unattended by danger of anaphylaxis and reduces the mortality.

Barenberger²⁰² does not believe that the vaccine exercises the slightest curative effect nor does it lessen the severity of the disease. As regards its prophylactic value, however, he states the case is different. In an experience with several epidemics he found that the percentage of vaccinated children who developed the disease was considerably less

²⁰⁰ New York Medical Record, February 22, 1919.

²⁰¹ Archives of Pediatrics, January, 1919.

²⁰² American Journal of Diseases of Children, July, 1918.

than those who were not vaccinated. In one epidemic it was possible to vaccinate children some weeks before they came in contact with cases of pertussis, and therefore there was no chance of their having been in the incubation stage at the time the prophylactic therapy was instituted.

Veronal. The administration of veronal is not infrequently followed by a skin eruption. Hartzell²⁰³ describes the skin eruption as being erythematous, usually morbilliform, less frequently scarlatinoid in appearance and often accompanied by itching which may be of the most distressing character. He refers to one case in which the eruption, which was a brilliant scarlet, covered every part of the skin and was accompanied by extreme itching and burning. The resemblance to scarlet fever was considerable.

X-rays. Brettauer²⁰⁴ reports 32 cases of *uterine fibroids* which were subjected to massive roentgen-ray exposures on account of severe *menorrhagia*. Permanent amenorrhea resulted in 25, or 78 per cent., and temporary amenorrhea in 7, or 22 per cent. Four of the latter group were between thirty and forty years of age and the character of the uterine bleeding was that of a scanty regular menstruation; in the other 3, the flow was very irregular, small in amount and occurred at intervals of from three to six months.

In nearly every case a decided reduction of the size of the uterus was perceptible and in some no vestige could be detected of former large fibroids.

Brettauer concludes that at an age below forty-five years, the x-rays should not be the choice, but should be employed only when operative measures are not advisable or are refused. Between the ages of forty-five and fifty-five years, x-ray treatment should be the method of choice and no patient should be deprived of the right to undergo it. Uterine hemorrhages in women beyond the age of fifty-five years should raise a suspicion of sarcomatous degeneration and operative measures are preferable to any other form of treatment.

Broun²⁰⁵ has analyzed 1500 cases of myomata uteri and of this number 355, or 23.7 per cent., contra-indicated the use of radium or the x-rays. The average therefore of 23.7 per cent., or practically one out of every four patients seeking relief from symptoms resulting from the presence of uterine myoma, have some other pathologic condition which would contra-indicate the use of radium and the x-rays. Among these associated lesions are: tubal disease, ovarian disease, acute or chronic appendicitis and necrotic or calcareous changes in the fibroid itself.

After reviewing these cases, Broun is convinced that the symptoms on account of which the majority of patients entered the hospital were due, in the greatest measure, to conditions outside of the uterus and not to the presence of the tumor itself unless it was from hemorrhage. He does not question the value of radium and the x-rays in certain cases

²⁰³ Pennsylvania Medical Journal, February, 1919.

²⁰⁴ American Journal of Obstetrics and Diseases of Women and Children, September, 1918.

²⁰⁵ Ibid.

but he believes that the field should be limited to cases in which it is inadvisable to do any form of operation and to hemorrhage of myopathic origin or from small and absolutely uncomplicated myomas of the uterus.

An interesting case of pregnancy following the use of the *x*-rays for *metritis* is reported by Conill.²⁰⁶ The case was that of a woman who had been married at the age of seventeen years and at twenty-five years was cured for menstrual irregularities. The latter condition persisted until the age of forty years, when the bleeding became so severe that roentgen-ray treatment was advised. At this time the uterus was very large, reaching above the umbilicus and apparently the seat of a diffuse fibromatosis or metritis. Four treatments were given and then stopped because of the influenza epidemic. When the woman returned it was found that she was pregnant; later she gave birth to a healthy child, the first after twenty-three years of sterility.

EXOPTHALMIC GOITRE. It has been recognized for some time that in addition to enlargement of the thyroid there is also associated with it *hypertrophy of the thymus gland*. Nordentoft²⁰⁷ takes up this association in considering the *x*-ray treatment of exophthalmic goitre. He reports 50 cases of the goitre. Under ordinary conditions he believes that the thyroid and the thymus have an antagonistic action, but with exophthalmic goitre they seem to work in concert. In treating these cases roentgen exposure was made for from forty to sixty minutes at one sitting. Two or three exposures, with intervals of from four to six or eight weeks, usually sufficed. The effect on the subject symptoms was marked from the first, the restlessness, tremor and heart disturbances subsiding first; the goitre and exophthalmos more gradually; the most resistant symptom being the tachycardia. In several cases a single exposure was sufficient. His 50 patients were given a total of ninety-nine sittings and in 84 the thymus was exposed as well as the thyroid. He cites cases from the literature and his own experience which go to show that cases presenting the picture of exophthalmic goitre fail to improve either from treatment by the roentgen rays or by thyroidectomy, which were relieved of their symptoms when the thymus was attacked.

Such experiences, he believes, teach the necessity for applying roentgen treatment to the thymus as well as the thyroid in these cases. In Nordentoft's opinion operative removal of the thyroid should not be done until the roentgen rays have failed; and this he thinks will be a rare occurrence. He further believes that the region of the thymus should be exposed to the *x*-rays before operating on the thyroid.

It is well known that the thymus gland is particularly susceptible to the influence of the *x*-rays and for this reason this method of treatment is the use of choice. I have known of several cases of persistent thymus employment in children that was favorably influenced by so slight an exposure as that which occurs in taking a chest plate for diagnostic

²⁰⁶ Abstract, Journal of the American Medical Association, August 9, 1919, p. 459.

²⁰⁷ Ugeskrift for Laeger, August 22, 1918; abstract, Journal of the American Medical Association, November 16, 1918, p. 1702.

purposes. Benjamin²⁰⁸ in reporting 19 cases of hyperplasia of the thymus gland in children emphasizes the importance of bearing in mind the relative frequency of this condition and the excellent results obtained by means of roentgen therapy. While I have no knowledge of fatalities following the roentgen treatment of exophthalmic goitre Secher²⁰⁹ stated that cases are on record in which the treatment led to excessive functioning of the thyroid or had made it functionally insufficient. He reports the case of a woman, aged forty years, who was previously healthy until she developed an exophthalmic goitre.

A year after its appearance she was given eight exposures of the roentgen rays. Both the thyroid and thymus glands were exposed. Her symptoms became much aggravated, with restlessness, choreiform movements, extreme tachycardia and rapid respirations with death on the fifth day. In this case it would seem that overdosage at too frequent intervals was a factor in bringing about a fatal result.

EPITHELIOMA. MacKee²¹⁰ has treated 258 cases of basal-cell epithelioma with the *x*-rays and *radium*; 222 of these cases were under observation for at least a few months. Among 158 cured cases observed for periods of from six months to five years or more there were twenty-four relapses, leaving a total of 85 per cent. of possible permanent cures. Nineteen of the 24 patients with relapses were treated again with the *x*-rays, and 17 recovered. Two patients were cured with *radium* and 2 by surgical excision. In 5 cases relapses occurred a second time within a year after the second recovery. In 4 of these cases the lesions again disappeared under further roentgen-ray treatment and the fifth case failed to respond to either the *x*-rays or *radium*.

²⁰⁸ Archives of Pediatrics, February, 1918.

²⁰⁹ Ugeskrift for Læger, September 19, 1918; abstract, Journal of the American Medical Association, December 7, 1918, p. 1950.

²¹⁰ American Journal of Roentgenology, March, 1919.

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